BLM LIBRARY
88076843

Draft
Environmental Impact Statement for the Arturo Mine Project

Bureau of Land Management

BLM

Elko District Office, Tuscarora Field Office, Nevada

December 2012

BLM Mission Statement

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/NV/EK/ES/12-18+1793

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Elko District Office
3900 East Idaho Street
Elko, Nevada 89801
http://www.blm.gov/nv/st/en/fo/elko_field_office.html

In Reply Refer To:
3809 (NVE02000)
NVN-87946

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement (DEIS) for Barrick-Dee Mining Venture Inc.'s (BDMV) proposed Arturo Mine Project. The proposed Project includes the expansion of the existing open pit, construction of two new waste rock disposal storage facilities, construction of a new heap leach facility, and the construction of new support facilities (i.e. substation and associated transmission powerline, water wells, office, and roads). Mill grade mined material would be transported to Barrick's Goldstrike Mine Facility for processing. No dewatering is proposed for this project. The proposed project would create approximately 2,703 acres of surface disturbance on public land administered by the BLM. The project life is approximately ten years of mining and ore processing and will employ 240 workers. The proposed project is located approximately 45 miles northwest of Elko, in Elko County, Nevada at the previously authorized Dee Gold Mine site.

A 45-day public comment period begins the day the Environmental Protection Agency publishes the Notice of Availability in the Federal Register. You may submit comments related to the Arturo Mine Project by any of the following methods:

- E-mail: BLM_NV_ELDOArturoEISTeam@blm.gov;
- Fax: 775-753-0255; or
- Mail: Bureau of Land Management, Arturo Mine Project, Attention: John Daniel, Project Manager, 3900 Idaho Street, Elko, NV 89801.

Copies of the Arturo Mine Project DEIS are available in the BLM Elko District Office at the above address, and on line at http://www.blm.gov/nv/st/en/fo/elko_field_office.html.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment–including your personal identifying information–may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Should you have any questions, please contact John Daniel at (775) 753-0277.

Sincerely,

Richard E Adams

Richard E. Adams,
Field Manager
Tuscarora Field Office

856655244
88076843
HD
243
.N3
A78
2012

ARTURO MINE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

Project Name:	Draft Environmental Impact Statement Barrick-Dee Mining Venture
Lead Agency:	U.S. Department of the Interior Bureau of Land Management Elko District Office, Tuscarora Field Office Elko, Nevada
Cooperating Agencies:	Nevada Department of Wildlife Elko County Board of Commissioners
Project Location:	Elko County, Nevada
Correspondence on this EIS Should be Directed to:	John Daniel, EIS Project Coordinator Bureau of Land Management Tuscarora Field Office 3900 Idaho Street Elko, NV 89801
Date by which Comments Must be Postmarked to BLM:	Within 45 days of the date of the Notice of Availability published in the Federal Register

ABSTRACT

This Draft Environmental Impact Statement analyzes potential impacts associated with Barrick-Dee Mining Venture (BDVM) proposal for the Arturo Mine Project (Proposed Action). The Proposed Action is to develop the Arturo Mine Project which includes the expansion of the Dee Gold Mine and the construction of new process and ancillary facilities. The proposed project is located in the northern end of the Carlin Trend, approximately 45 miles northwest of Elko, in Elko County, Nevada at the existing Dee Gold Mine site. The proposed Project includes the expansion of the existing open pit, construction of two new waste rock disposal storage facilities, construction of a new heap leach facility, and the construction of new support facilities (i.e., substation and associated transmission powerline, water wells, office, and roads). Mill grade ore would be transported to Barrick's Goldstrike Mine Facility for processing. No dewatering is proposed for the Arturo Mine Project. The proposed project would create approximately 2,703 acres of surface disturbance on public land administered by the BLM. The project life is approximately 10 years of mining and ore processing and would employ 240 workers. The agency preferred alternative is the Proposed Action.

Responsible Official for Draft EIS:	Richard E. Adams, Field Manager Tuscarora Field Office

Executive Summary

Introduction

Barrick-Dee Mining Venture (BDMV) proposes to construct, operate, and reclaim the Arturo Mine Project (Proposed Action/project), which would include development of new facilities and expansion of previously disturbed gold mining areas at the Dee Gold Mine. BDMV is a joint venture between Barrick Gold Exploration Inc., the venture manager, and Marigold Mining Company (Marigold), a subsidiary of Goldcorp Inc. The proposed project is located on the northern end of the Carlin Trend in Elko County, Nevada, approximately 27 aerial miles northwest of the town of Carlin.

Summary of the Proposed Action

BDMV is proposing an expansion of the existing Dee Gold Mine, which currently is in reclamation and closure. A Plan of Operations (NVN-087946) for the proposed project was submitted by BDMV to the Bureau of Land Management (BLM) in June 2009. The Proposed Action would include expansion of the existing open-pit; construction of two new waste rock disposal facilities (WRDFs) (the East and West WRDFs); construction of a new heap leach pad (Heap Leach Pad No. 12) and gold processing facilities; upgrading and re-aligning segments of the Bootstrap Haul Road, including light vehicle access; construction and/or relocation of support facilities, including office buildings and a communication site; construction and installation of new power transmission lines; and continued surface exploration within the project area.

Mill-grade ore would be transported via the Bootstrap Haul Road right-of-way (ROW) NVN-007683 and processed by contract at the existing Barrick Goldstrike Mines Inc. (BGMI) facilities located approximately 3.5 road miles southeast of the existing Dee Gold Mine. Low-grade leachable ore would be processed on-site at the proposed heap leach pad and associated processing facilities.

The Proposed Action would disturb a total of 2,774 acres, of which 2,703 acres are public lands administered by the BLM and 71 acres are private land. The proposed surface disturbance would include 269 acres of existing disturbance, 543 acres of reclaimed mining disturbance, and 1,962 acres of new disturbance.

Proposed project construction would begin in early 2013 pending authorization of permits and approvals. Mine operations would begin within 8 months of construction start-up, and would continue for approximately 8 years depending on mining and economic conditions. Ore processing would continue for an additional 2 years beyond the end of mining operations. To the extent possible, reclamation would occur concurrently with mining operations. Final reclamation would be completed during a 4-year period following cessation of mining. At the end of mine life, BDMV would reclaim all the facilities associated with the project, except the expanded pit and roads included in the BLM road system. Post-closure monitoring could continue for 30 years or more, depending on the project's final closure plan and its implementation.

Summary of the Project Alternatives

Three alternatives to the Proposed Action were considered for detailed analysis in the environmental impact statement (EIS): the Single WRDF, Partial Pit Backfill, and the No Action alternatives. Five other alternatives were considered but eliminated from detailed analysis.

Summary of Impacts Associated with the Proposed Action and Alternatives

Geology and Minerals

Direct impacts on geologic and mineral resources from the Proposed Action would include: 1) the generation and permanent disposal of approximately 600 million tons (MT) of waste rock and 64 MT of spent ore material, and 2) the mining of proven and probable ore reserves of approximately 2.2 million ounces of gold and 10.6 million ounces of silver.

The construction and operation of the proposed open pit, WRDFs and heap leach pad would permanently alter the natural topographic and geomorphic features over approximately 2,123 acres, including 601 acres of open pit that would not be reclaimed. The WRDFs and heap leach pad would be reclaimed but would alter the topography and geomorphology of the study area. Other temporary facilities including approximately 651 acres of stockpiles, process facilities, ancillary facilities, and haul roads would be reclaimed to the approximate pre-mining topography and therefore would not permanently alter the natural topography and geomorphic features in the study area.

Geotechnical studies and stability analysis of the proposed open pit, WRDF and heap leach facility indicated that the facilities would be stable during construction and operation of the proposed project. Additional geotechnical studies would be incorporated into the final design, operation and maintenance procedures, and closure of these facilities and the process area ponds.

Water Resources and Geochemistry

No perennial stream reaches are located within the study area. Based on the lack of perennial stream reaches, the short reaches of relatively small ephemeral drainages removed by proposed project components, and the proposed storm water management controls; direct impacts to stream flows in Boulder Creek and the Antelope Creek drainage would be minimal. The U.S Army Corp of Engineers has concurred that water features in the proposed project area are not subject to federal jurisdiction, and thus not regulated under Section 404 of the Clean Water Act.

Twelve seep features would be affected either by burial under proposed project components or by removal of water sources adjacent to the proposed pit expansion. These impacts would minimally affect surface water or groundwater resources, and would primarily involve habitat effects. Springs would not be affected by the Proposed Action.

Mine dewatering would not be required for the Proposed Action due to the influence of pumping at the BGMI facility. Any pumping required to control localized perched groundwater during open-pit mining is unlikely to result in additional drawdown in the carbonate aquifer over that which has been previously predicted and analyzed for the BGMI facility. Dewatering at the BGMI facility is predicted to end in 2021, after which regional groundwater levels gradually would rise. After dewatering ceases at the BMGI facility, the groundwater levels in the carbonate aquifer would rise above the bottom of the proposed open pit and result in the development of three separate pit lakes in the North, South, and East lobes of the open pit. The groundwater model predicts that during the early stages of recovery, local water tables would develop in the Carlin and Vinini formations that represent perched groundwater systems above the carbonate aquifer system. After approximately 200 years of recovery, the pit lakes are expected to behave as a hydrologic sink (i.e., hydrologic capture zone where there is groundwater inflow that is lost to evaporation and, therefore, no outflow to the groundwater system). The pit lakes predicted water chemistries exceed some water quality standards; however, it is anticipated that in the long term (after approximately 200 years), these lakes would not affect the water quality of downgradient aquifers.

The Proposed Action would not affect water rights in the project area.

The WRDFs are designed and would be constructed to minimize the risk of impact to waters of the State and impacts to groundwater and surface water from seepage from the WRDFs are anticipated to be negligible. Soil covers implemented at closure would reduce or eliminate infiltration of water and oxygen. A waste rock management plan provides for a selective waste rock handling program, which incorporates the net alkaline character of waste rock and the relatively small volume of potentially acid-generating material (PAG) for the proposed project.

Because the proposed project would be designed and operated as a zero-discharge facility in accordance with NDEP mining regulations, impacts from process fluids would be unlikely under anticipated construction and operating conditions. Compliance with interagency closure and reclamation requirements, including monitoring, would minimize the potential for long-term effects on surface water quality after cessation of proposed project operations. Based on these project commitments, no impacts to surface water quality are anticipated from process components under anticipated construction, operating, and closure conditions.

Arturo ore processing at the BGMI facility would be conducted under currently permitted authorizations. As a result, no additional impacts to surface water quality are anticipated from ore processing at the existing BGMI process facilities. Incremental water quality impacts to Boulder or Bell creeks are not anticipated from the Bootstrap Haul Road modification and maintenance.

Cultural Resources

A total of 29 National Register of Historic Places (NRHP)-eligible prehistoric sites that cannot be avoided by project construction have been, or would be, mitigated through implementation of a Historic Properties Treatment Plan and in accordance with the Memorandum of Agreement developed by the BLM Elko District Office in consultation with the State Historic Preservation Office (SHPO). There would be an opportunity for Native American monitors to be present during data recovery. The BLM and SHPO-approved Historic Properties Treatment Plan would be implemented prior to BLM issuing a notice to proceed. If any previously unknown archaeological sites or human remains are discovered during construction, all construction activities would immediately cease within 300 feet of the discovery, and the BLM Authorized Officer would be notified of the find. Steps would be taken to protect the site from vandalism or further damage until the BLM Authorized Officer evaluated the nature of the discovery.

Native American Traditional Values

In consultation with the Nevada State Historic Preservation Office and the Tribes, the BLM would determine whether construction and operation of the proposed project would have an adverse effect on any historic properties of traditional religious and cultural importance to the Tribes. If the BLM determines that historic properties of traditional religious and cultural importance would be adversely affected, mitigation would be proposed. The inadvertent discovery of human remains would follow the procedures stated in the Native American Graves Protection and Repatriation Act. Potential effects to Native American traditional values as a result of the proposed project could include potential damage to archaeological sites, illegal collecting of artifacts, and effects to springs, seeps, and streams. Impacts to archaeological sites from proposed surface disturbance activities have been or would be mitigated according to the HPTP by site avoidance or data recovery. No illegal collecting of artifacts or looting would occur because all of the historic properties located within or adjacent to the study area have been or would undergo data recovery prior to project construction.

Government-to-government consultation is ongoing regarding potential effects to any identified properties of traditional religious and cultural importance and graves/burials and their possible mitigation.

Hazardous Materials and Solid Waste

The transport, storage, use, and disposal of hazardous materials would occur during the construction and operation of the proposed project in accordance with federal, state and local regulations. Based on the facility's design features and the operational practices in place, the probability of a major release occurring at the site or along transportation routes would be low. Any release would be reported and mitigated according to federal and state law.

All hazardous waste generated at the mine would be accumulated and transported to licensed disposal facilities in accordance with applicable federal and state regulations. The proposed project would be classified as a Small Quantity Generator under RCRA. Non-hazardous solid waste would be disposed of in the proposed Class III waivered landfill located within the proposed West WRDF or other off-site permitted landfill.

Air Quality

Air dispersion modeling results indicate that the proposed project would not exceed state or national Ambient Air Quality Standards for $PM_{2.5}$, PM_{10}, nitrogen dioxide, carbon monoxide, and sulfur dioxide.

No individual hazardous air pollutants (HAPs) would be emitted in a quantity greater than the major source limit of 10 tons per year (tpy), and the combined HAP emissions are less than the major source limit of 25 tpy. Therefore, the Proposed Action would not constitute a major HAP source.

Fugitive and combustion emissions (criteria pollutant emissions) were quantified for hauling ore from the proposed project to the BGMI facility along the Bootstrap Haul Road. Additionally, an estimate of criteria pollutants and HAPs emissions attributed to processing ore from the proposed project at the BGMI facility (under the BGMI existing air permit) was completed. The maximum potential hourly emissions of mercury at the BGMI facilities would not increase due to the processing of Arturo ore, and there would be no projected increases in total annual mercury emissions from the facility.

Paleontological Resources

Destruction, damage, or loss of fossils could potentially occur from general construction activities, waste rock disposal, heap leach facility, and pit development in the Carlin Formation, which has a potential to contain scientifically important fossils, especially vertebrates. However, recent surveys of the Carlin Formation within the vicinity of the proposed project and CESA have resulted in the collection of few recognizable vertebrate fossils.

There is a very low risk of impacts to fossils on previously authorized disturbed lands. Proposed disturbance is not likely to affect paleontological resources in the Paleozoic rocks and alluvium because these rock units have a low potential to contain scientifically important fossils.

Social and Economic Values

The Proposed Action would result in temporary increases in local construction jobs and longer-term increases in mining sector employment primarily in Elko and Eureka counties. The Proposed Action would employ approximately 100 construction workers during the construction phase of the project. The maximum employment impact during construction represents less than 0.4 percent of total employment in the two-county study area.

The Proposed Action would employ an average of more than 200 workers during the operations and processing phase of the project. At its peak, the maximum operations employment effect would be approximately 659 workers, including indirect employment. The 2016 peak employment during operations would represent a 2.6 percent increase over total 2008 employment in the two-county study area. It would reduce the unemployment rate to approximately 5.8 percent, if all of the jobs were filled by new hires from the local area. No significant capacity or service issues have been identified for public facilities, services, or education in the two-county study area.

The estimated average annual payroll, including benefits, for proposed project salaried and hourly workers combined would be $84,000. Consequently, the direct payroll would range from $4.2 million (2020) to $31.8 million (2016) and would total approximately $159.1 million during the 8-year operating life of the mine. The annual indirect earnings effect would range from $1.5 million to $11.8 million and the total combined effect would be approximately $218.0 million during the operating life of the project. The increase in income earnings would be a substantial economic benefit accruing to the local economy.

The proposed project would generate public revenues primarily from sales and use taxes and net proceeds of mines taxes. BDMV estimates the project would pay sales taxes of $1.4 million in 2013 and $0.8 million in 2014. Estimated sales taxes in subsequent years would range from $39,000 to $179,000, and would average approximately $105,000 per year. Total sales taxes over the 8 year project life are estimated at $2.8 million, divided among the state ($826.000), the school districts ($1,074,000), Elko County ($207,000) and the counties revenue sharing pool ($723,000). BDMV estimates total net proceeds taxes from the proposed project at $34.8 million, ranging from $352,000 in 2013 to $9.8 million in 2020, although with considerable variation over the 8-year mine life.

Recreation and Wilderness

The proposed project would add approximately 1,962 acres to the existing or reclaimed disturbance of 812 acres. The proposed disturbance areas would be removed from public access for recreation purposes for the life of the project. Upon completion of mining, ore processing, closure, and reclamation, approximately 601 acres of disturbed land associated with the open pit would remain unreclaimed, but 2,173 reclaimed acres would be available for dispersed recreation use. Because there is an ample supply of alternative land for dispersed recreation activities in the project vicinity, and because no unique recreation resources would be impacted as a result of the proposed project, effects on recreation resources would be considered minor.

The project area does not contain any land that meets the criteria for wilderness characteristics or designation. There would be no adverse effects from the proposed project on wilderness or wilderness study areas.

Visual Resources

Development of the proposed project would expand the amount of visual contrast that currently exists between existing and previously approved facilities, and the natural character of the landscape. The primary change in visual effects would be the addition of landforms of the West WRDF, East WRDF, Heap Leach Pad No. 12, new mine facilities buildings, and the power transmission line. The proposed project also would extend visual effects through the increased use and activities of the area from the proposed mining activity. The proposed facilities would have visual characteristics during active mining that would be similar to existing facilities, notably a geometric form and exposed earth surfaces. As a result, the proposed project would have similar, but expanded, visual effects to those already occurring from the existing facilities. The visual contrast effects would become less prominent with reclamation.

The proposed project would comply with the Class IV objective during active mining and after reclamation because this objective provides for "management activities, which require major modification of the existing character of the landscape." In addition, public use of travel routes in the viewshed would occur at a low level.

Soils and Reclamation

The Proposed Action would disturb approximately 2,505 acres of soil from areas previously disturbed but reclaimed (543 acres) or new land disturbance (1962 acres). Replacement of growth media and revegetation of disturbed areas would be conducted as soon as practical to minimize impacts to soils and vegetation and facilitate post-mining land uses. Impacts would be reduced based on BDMV's commitment to reclaim project components and successfully restore productive post-mining land uses. It is likely that short- to long-term (e.g., up to 10 years or more) decreases in soil quality would not limit the attainment of overall post-mining land use objectives. Over time, soil quality on reclaimed and revegetated sites would resemble pre-mining conditions. A permanent loss of soil productivity would occur on approximately 472 acres of previously reclaimed or newly disturbed land with expansion of the propose open pit which would not be reclaimed.

Vegetation Resources

The proposed project would disturb approximately 2,774 acres of which 1,960 acres are sagebrush shrublands, 2 acres are riparian zones/wetland areas, 543 acres are reclaimed grasslands from previous mining disturbance, and 269 acres are existing disturbance. The majority of the proposed surface disturbance (approximately 2,173 acres) would be reclaimed with the 601 acres of the open pit remaining unreclaimed post-closure.

The construction of the open pit would affect three wetlands. Widening and realigning the Bootstrap Haul Road would disturb an additional two wetlands where the road crosses the Boulder Creek stream channel. The potential impacts of the proposed project on riparian zones and wetlands would predominantly be long-term, consisting of permanent changes irrespective of post-closure and reclamation success. Mitigation of project-related impacts that would affect 1.6 acres of riparian and wetland vegetation would include the enhancement and restoration of 34 acres of vegetation, including three springs, located at an offsite location within the Water Canyon spring complex.

Satisfactory revegetation of disturbance areas is anticipated to occur approximately 3 to 15 years following reclamation. After 25 years, the reclaimed plant communities likely would consist of adequate herbaceous plant cover with sufficient diversity to substantially reduce the potential for soil erosion and provide forage for use by livestock and wildlife.

Noxious Weeds and Non-native Invasive Plant Species

Implementation of the measures outlined in BDMV's applicant-committed environmental protection measures and the proposed reclamation plan and weed management plan would reduce the potential for noxious weeds and non-native invasive plant species establishment in the area. Measures to be implemented to prevent the spread of noxious weeds would include seeding growth media stockpiles as soon as practical with an interim seed mix, using certified weed-free hay and straw, and reclaiming with a BLM- approved seed mix.

Range Resources

The proposed project would exclude 3,333 acres of rangeland vegetation in the Twenty Five Allotment and 24 acres of rangeland vegetation in the T Lazy S Allotment from grazing. Animal Unit Months (AUMs) suspended directly from the proposed project would be approximately 687 AUMs in the Twenty Five Allotment. AUMs suspended based on the proposed project in combination with the current configuration of the Boulder Seeding Fence would total 1,272 AUMs in the Twenty Five Allotment. Long-term impacts would result in the loss of 472 acres and a reduction of 95 AUMs within the Twenty Five Allotment from the expansion of the existing open pit, which would not be reclaimed.

The proposed project would result in the short-term loss of forage during facility construction, operation, and reclamation of the proposed project; and a long-term loss of forage from the expansion of the open pit. The installation of the perimeter fence would result in the loss of forage, restrict cattle movement, and limit access to water sources. An increase in traffic, especially along the Bootstrap Haul Road, could lead to increased mortality and injuries to livestock, and cause disruptions to livestock management. Vehicle traffic along the Bootstrap Haul Road would disrupt livestock management during seasonal cattle movements between summer and winter grazing areas.

Indirect impacts would include the potential spread of noxious weeds and non-native invasive plant species, and an increase in fugitive dust that could result in a reduction of forage and forage quality. The conversion of native vegetative communities and associated loss of forage could potentially be a permanent change resulting in a long-term impact. Water quality in ponds and reservoirs could be impacted as a result of erosion from construction activities.

Impacts to grazing resources would be minimized through the implementation of applicant-committed environmental protection measures including measures to facilitate cattle movement and to provide additional water sources during seasonal cattle drives. In addition, the existing Boulder Seeding Fence would be reconfigured to reduce the amount of AUMs affected by the Proposed Action.

Wildlife

The proposed project would result in the long-term reduction of approximately 2,505 acres of wildlife habitat, including approximately 1,960 acres of sagebrush shrubland, 543 acres of grassland, and approximately 2 acres of riparian zones/wetland areas. The disturbed habitat associated with the proposed project would be reclaimed following completion of mining activities with the exception of 472 acres of sagebrush shrubland, grassland and wetland associated with the open pit expansion. Mitigation of project-related impacts that would affect riparian and wetland vegetation would include the enhancement and restoration of 34 acres of vegetation, including three springs and five pit reservoirs, located at an offsite location within the Water Canyon spring complex.

Indirect impacts would include increased noise, additional human presence, and the potential for increased vehicle-related mortalities. No fish or amphibian species were observed in the three wetlands in the open pit expansion and the two wetlands at the Bootstrap Haul Road crossing over Boulder Creek that would be lost as a result of the project.

The proposed project occurs within an important mule deer migration corridor. Potential direct impacts to big game (mule deer, pronghorn, and elk) would include the incremental long-term reduction of potential forage and the incremental increase in habitat fragmentation from vegetation removal associated with mine development activities. The project would disturb approximately 1,391 acres of limited use habitat for mule deer, consisting primarily of sagebrush shrubland habitat, and 2,505 acres of summer habitat for pronghorn. Potential direct impacts to elk would include the incremental long-term reduction of approximately 1,940 acres of crucial winter habitat within the study area and approximately 19 acres of low-density habitat. Mitigation of project-related impacts that would affect 1,391 acres of sagebrush shrubland habitat for migrating mule deer would include the enhancement and restoration of important summer and winter mule deer range at offsite locations at a ratio of 1:1. In addition, disturbed areas would be reclaimed as soon as possible to increase the width of the remaining migration corridor and to encourage use by mule deer and other big game.

Direct impacts to small game and nongame species would include the incremental long-term reduction of approximately 2,505 acres of potentially suitable habitat. Impacts also would include displacement from the disturbance areas and increased habitat fragmentation, until reclamation has been completed and vegetation is re-established.

Potential direct impacts to bird species would include the temporary loss of approximately 2,505 acres of potentially suitable breeding, roosting, and foraging habitat. However, this temporary loss is expected to have little effect on local bird populations based on the amount of suitable breeding and foraging habitat in the surrounding area. Additionally, a number of applicant-committed environmental protection measures would be implemented to minimize impacts.

Applicant-committed environmental protection measures involving erosion and sediment control BMPs would be used to reduce sediment input from project facilities and disturbed areas into Boulder Creek, as defined by the site Storm Water Pollution Prevention Plan. By implementing the erosion control measures, project-related impacts of sediment on Boulder Creek and aquatic biota are considered to be minor. No impacts due to water management activities would occur to habitat along Boulder Creek and associated aquatic species.

Special Status Species

Impacts to some special status species would include the long-term loss of approximately 2,505 acres of potentially suitable habitat. Based on the limited habitat to be disturbed and available habitat in the vicinity, potential impacts to these species as a result of the proposed project would be low. A long-term loss of approximately 1,960 acres of potentially suitable sagebrush shrubland habitat would potentially impact some special status species. These impacts would be considered low considering the small amount of disturbance and the availability of similar habitat in the study area. Mitigation of project-related impacts that would affect approximately 808 acres of important greater sage-grouse habitat would include the enhancement and restoration of important greater sage-grouse habitat at offsite locations at a ratio of 2:1.

Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals, and the displacement of more mobile species into adjacent habitats. In areas where habitats are at, or near, carrying capacity, animal displacement could result in some unquantifiable reductions in local wildlife populations. Mine-related surface disturbance also would result in an incremental increase in habitat fragmentation at the mine site until vegetation has been re-established.

Land Use and Access

The project area encompasses approximately 3,627 acres of which 3,551 acres are public lands administered by the BLM and approximately 76 acres are private lands. The proposed project would disturb a total of 2,774 acres of public (2,703 acres) and private (71 acres) land including 269 acres of existing disturbance; 543 acres of reclaimed mining disturbance, and 1,962 acres that would result in new land disturbance.

New project-related disturbance including a new fenced area around the proposed PoO boundary would reduce the amount of land available for livestock grazing and dispersed recreation, although the loss would be small relative to the total public land available for such activities in the project vicinity.

The proposed project would not conflict with the few existing ROWs in the project vicinity. The proposed changes to the existing power transmission line would not adversely affect land use or power availability in the area.

Post-reclamation land use of most of the disturbance area would be returned to open space, grazing, dispersed recreation, and wildlife habitat and would be consistent with local and BLM land use plans and guidelines.

Four categories of traffic would be generated on public roadways by the proposed project including construction traffic, worker commuting traffic, general company and contractor traffic, ore hauling, and material deliveries. Most traffic would access the project site using the Bootstrap Haul Road via SR 766 and Rodeo Flat Road (County Road 237a). Transportation safety concerns related to traffic generated by the proposed project would be minimal. The increase in traffic would be modest, remaining well within the capacity of the roadways. Development of the proposed project would not substantially affect highway traffic in the project region.

Noise

Noise levels substantially higher than ambient background noise levels would be generated in close proximity to the main noise generating activity centers including the open pit, the West WRDF, the East WRDF, the Heap Leach Pad No. 12, and mine traffic along the Bootstrap Haul Road. The noise from blasting would be increasingly reflected upward by the pit walls as the pit depth increased, which would reduce the noise levels outside the pit.

Noise level effects from the proposed project would be negligible as no identified noise-sensitive receptors were identified in the noise effects study area, and relatively modest noise levels were estimated from project-related activities.

Environmental Justice

The environmental analyses indicate that the potential effects of the proposed project would not be expected to disproportionately affect any particular population. The area in the immediate vicinity of the proposed project has no resident population. The nearest residences are a few remote ranches located several miles from the project area that have not been identified as minority or low-income in nature.

Energy Requirements and Climate Change

Greenhouse Gas (GHG) emissions associated with the Proposed Action would contribute approximately 80,220 CO_2(e) tpy from fuel combustion and 25,901 CO_2(e) tpy from electrical power for a total of 106,121 CO_2(e) tpy of GHG.

The proposed project would emit CO_2(e) that would incrementally add to the GHGs in the region from other sources including power plants, mining activities, industrial operations, vehicle traffic, wildfires, and other activities. The proposed project represents approximately 1 percent of the GHG emissions from all sources in the region, approximately 0.04 percent of the emissions in Nevada, and a tiny fraction of the emissions on a global basis. As a result, the proposed project would be expected to have a negligible effect on climate.

BLM-preferred Alternative

The Council on Environmental Quality Regulations (40 CFR 1502.14e) directs that an EIS “identify the agency’s preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.”

The BLM has selected an alternative based on the analysis in this EIS. The preferred alternative is one that best fulfills the agency’s statutory mission and responsibilities, considering economic, environmental, technical, and other factors. The BLM has determined the preferred alternative is the Proposed Action.

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
afy	acre feet per year
AGFD	Arizona Game and Fish Department
AGP	acid generation potential
ags	above ground surface
AIRFA	American Indian Religious Freedom Act
amsl	above mean sea level
ANP	acid neutralizing potential
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
ARD	acid rock drainage
ARPA	Archaeological Resources Protection Act
AUM	animal unit month
BAPC	Bureau of Air Pollution Control
BATF	Bureau of Alcohol, Tobacco, and Firearms
BCC	Birds of Conservation Concern
BDMV	Barrick-Dee Mining Venture
BEA	Bureau of Economic Analysis
BGMI	Barrick Goldstrike Mines Inc.
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practices
BMRR	Bureau of Mining Regulation and Reclamation
BVMP	Boulder Valley Monitoring Plan
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CDC	Centers for Disease Control
Cedar Creek	Cedar Creek Associates, Inc.
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act

CESA	Cumulative Effects Study Area
CFR	Code of Federal Register
CH_3Hg+	methylmercury
CH_4	methane
CIL	carbon-in-leach
CN	cyanide
CO	carbon monoxide
CO_2	carbon dioxide
$CO_2(e)$	carbon dioxide equivalent
COPC	constituent of potential concern
CWA	Clean Water Act
dBA	decibels on the A-weighted scale
DWR	Division of Water Resources
EA	Environmental Assessment
ECPLPP	Elko County Public Lands Policy Plan
EIS	Environmental Impact Statement
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
ERA	ecological risk assessment
ESA	Endangered Species Act
ET	evapotranspiration
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FY	fiscal year
GBC	Great Basin College
GHG	greenhouse gas
Goldcorp	Goldcorp Inc.
gpm	gallons per minute
GWP	global warming potential
HAP	hazardous air pollutant
HDPE	high density polyethylene
Hg^0	gaseous mercury
HPTP	Historic Properties Treatment Plan
HQ	hazard quotient
HUD	Housing and Urban Development

I-80	Interstate 80
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPCC	Intergovernmental Panel on Climate Change
JBR	JBR Environmental Consultants, Inc.
JSA	John Shomaker & Associates, Inc
kg/t	kilograms per ton
KOP	key observation points
kV	kilovolt
LCRS	leak collection and recovery system
L_{dn}	day-night average sound levels
L_{max}	maximum sound level
LOAEL	lowest observed adverse effect level
LOEC	lowest observed adverse effect concentrations
MACT	Maximum Achievable Control Technology
Marigold	Marigold Mining Company
MBTA	Migratory Bird Treaty Act
MC	Maggie Creek
MCL	Maximum Contaminant Levels
MCP	Mercury Control Program
mg/l	milligrams per liter
mgd	million gallons per day
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSA	Micropolitan Statistical Area
MSDS	Material Safety Data Sheets
MSHA	Mine Safety and Health Administration
MT	million tons
MWMP	Meteoric Water Mobility Procedure
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NAG	net acid generating
NAGPRA	Native American Graves Protection and Repatriation Act
NDEP	Nevada Division of Environmental Protection
NDETR	Nevada Department of Employment Training, and Rehabilitation
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife

NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
NNHP	Nevada National Heritage Program
NNP	net-neutralizing potential
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAEL	no observed adverse effect level
NOEC	no observed effect concentrations
NOI	Notice of Intent
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRS	Nevada Revised Statute
NSPS	New Source Performance Standards
NSR	New Source Review
NVCRIS	Nevada Cultural Resources Information System
NVMACT	Nevada Maximum Achievable Control Technology
NWR	National Wildlife Refuge
O_3	ozone
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
PAG	potentially acid generating
Pb	lead
PCPI	per capita personal income
PCS	Petroleum-contaminated Soils
PFYC	Potential Fossil Yield Classification
PIF	Partners in Flight
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PoO	Plan of Operations
ppm	parts per million
PPH	preliminary priority habitat
PGH	preliminary general habitat

PSD	Prevention of Significant Deterioration
RCG	Rodeo Creek Gold
RCRA	Resource Conservation and Recovery Act
REMSAD	Regional Modeling System for Aerosols and Deposition
RFFA	reasonably foreseeable future actions
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
s.u.	standard unit
SARA	Superfund Amendments and Reauthorization Act
SH	State Highway
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SPL	Sound pressure levels
SR	State Road
SRA	South Fork State Recreation Area
SRK	SRK Consulting (U.S.), Inc.
SRMA	Special Recreation Management Area
SWCA	SWCA Environmental Consultants
SWPPP	Storm Water Pollution Prevention Plan
TCP	traditional cultural property
TD1	Tailings Disposal Facility No. 1
TD2	Tailings Disposal Facility No. 2
TDS	Total Dissolved Solids
tpd	tons per day
tpy	tons per year
TRV	toxicity reference values
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	United States Department of the Interior
USDOT	United States Department of Transportation

USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
vpd	vehicles per day
VRM	Visual Resource Management
WPCP	Water Pollution Control Permit
WRDF	Waste Rock Disposal Facility
WSA	Wilderness Study Area

Table of Contents

1.0 Introduction 1-1

1.1 Introduction and General Location 1-1
1.2 Current Status of the Dee Gold Mine 1-5
1.3 History of Plans of Operation and Rights-of-Way Associated with the Dee Gold Mine 1-5
1.4 Purpose and Need for Action 1-5
1.5 Relationship to BLM and Non-BLM Policies, Plans, and Programs 1-6
  1.5.1 Land Use Plan Conformance 1-6
  1.5.2 State and Local Land Use Plans and Policies 1-6
1.6 Environmental Review Process 1-6
1.7 Project Permits and Approvals 1-7
1.8 Summary of Key Issues 1-8
1.9 Organization of the Environmental Impact Statement 1-8

2.0 Description of Alternatives Including the Proposed Action 2-1

2.1 Introduction 2-1
2.2 Project Background 2-1
  2.2.1 Ownership History 2-1
  2.2.2 Permitting History 2-2
  2.2.3 Existing Facilities 2-3
2.3 Proposed Action 2-7
  2.3.1 Land Disturbance and Land Ownership 2-7
  2.3.2 Open Pit 2-12
  2.3.3 Waste Rock Disposal Facilities 2-16
  2.3.4 Ore Processing 2-20
  2.3.5 Haul Roads and Site Access Roads 2-26
  2.3.6 Ancillary and Support Facilities 2-29
  2.3.7 Schedule and Work Force 2-34
  2.3.8 Closure and Reclamation Plan 2-36
  2.3.9 Applicant-committed Environmental Protection Measures 2-46
2.4 Alternatives to the Proposed Action 2-52
  2.4.1 Single WRDF Alternative 2-54
  2.4.2 Partial Pit Backfill Alternative 2-59
  2.4.3 No Action Alternative 2-67
  2.4.4 Alternatives Considered but Eliminated from Detailed Analysis 2-67
2.5 BLM-preferred Alternative 2-71

3.0 Affected Environment and Environmental Consequences 3.1-1

3.1 Introduction 3.1-1
  3.1.1 General Setting 3.1-2
  3.1.2 Supplemental Authorities 3.1-4

3.2 Past, Present, and Reasonably Foreseeable Future Actions 3.2-1
  3.2.1 Past and Present Actions 3.2-1
  3.2.2 Reasonably Foreseeable Future Actions 3.2-14

3.3 Geology and Minerals 3.3-1
  3.3.1 Affected Environment 3.3-1
  3.3.2 Environmental Consequences 3.3-11
  3.3.3 Cumulative Impacts 3.3-16
  3.3.4 Potential Monitoring and Mitigation Measures 3.3-17
  3.3.5 Residual Impacts 3.3-18

3.4 Water Resources and Geochemistry 3.4-1
  3.4.1 Affected Environment 3.4-1
  3.4.2 Environmental Consequences 3.4-24
  3.4.3 Cumulative Impacts 3.4-52
  3.4.4 Potential Monitoring and Mitigation Measures 3.4-56
  3.4.5 Residual Impacts 3.4-58

3.5 Cultural Resources 3.5-1
  3.5.1 Affected Environment 3.5-1
  3.5.2 Environmental Consequences 3.5-4
  3.5.3 Cumulative Impacts 3.5-8
  3.5.4 Potential Monitoring and Mitigation Measures 3.5-9
  3.5.5 Residual Impacts 3.5-9

3.6 Native American Traditional Values 3.6-1
  3.6.1 Affected Environment 3.6-1
  3.6.2 Environmental Consequences 3.6-7
  3.6.3 Cumulative Impacts 3.6-9
  3.6.4 Potential Monitoring and Mitigation Measures 3.6-10
  3.6.5 Residual Impacts 3.6-10

3.7 Hazardous Materials and Solid Waste 3.7-1
  3.7.1 Affected Environment 3.7-1
  3.7.2 Environmental Consequences 3.7-4
  3.7.3 Cumulative Impacts 3.7-6
  3.7.4 Potential Monitoring and Mitigation Measures 3.7-7
  3.7.5 Residual Impacts 3.7-7

3.8 Air Quality 3.8-1
  3.8.1 Affected Environment 3.8-1
  3.8.2 Environmental Consequences 3.8-8
  3.8.3 Cumulative Impacts 3.8-18
  3.8.4 Potential Monitoring and Mitigation Measures 3.8-20
  3.8.5 Residual Impacts 3.8-20

3.9 Paleontological Resources 3.9-1
3.9.1 Affected Environment 3.9-1
3.9.2 Environmental Consequences 3.9-5
3.9.3 Cumulative Impacts 3.9-6
3.9.4 Potential Monitoring and Mitigation Measures 3.9-6
3.9.5 Residual Impacts 3.9-7

3.10 Social and Economic Values 3.10-1
3.10.1 Affected Environment 3.10-1
3.10.2 Environmental Consequences 3.10-10
3.10.3 Cumulative Impacts 3.10-20
3.10.4 Potential Monitoring and Mitigation Measures 3.10-23
3.10.5 Residual Impacts 3.10-23

3.11 Recreation and Wilderness....................3.11-1
3.11.1 Affected Environment 3.11-1
3.11.2 Environmental Consequences 3.11-5
3.11.3 Cumulative Impacts 3.11-7
3.11.4 Potential Monitoring and Mitigation Measures 3.11-8
3.11.5 Residual Impacts 3.11-8

3.12 Visual Resources 3.12-1
3.12.1 Affected Environment 3.12-1
3.12.2 Environmental Consequences 3.12-5
3.12.3 Cumulative Impacts 3.12-12
3.12.4 Potential Monitoring and Mitigation Measures 3.12-13
3.12.5 Residual Impacts 3.12-13

3.13 Soils and Reclamation 3.13-1
3.13.1 Affected Environment 3.13-1
3.13.2 Environmental Consequences 3.13-4
3.13.3 Cumulative Impacts 3.13-10
3.13.4 Potential Monitoring and Mitigation Measures 3.13-12
3.13.5 Residual Impacts 3.13-12

3.14 Vegetation, Including Riparian Zones and Wetland Areas....................3.14-1
3.14.1 Affected Environment 3.14-1
3.14.2 Environmental Consequences 3.14-10
3.14.3 Cumulative Impacts 3.14-14
3.14.4 Potential Monitoring and Mitigation Measures 3.14-17
3.14.5 Residual Impacts 3.14-18

3.15 Noxious Weeds and Non-native Invasive Plant Species....................3.15-1
3.15.1 Affected Environment 3.15-1
3.15.2 Environmental Consequences 3.15-4
3.15.3 Cumulative Impacts 3.15-5
3.15.4 Potential Monitoring and Mitigation Measures 3.15-6
3.15.5 Residual Impacts 3.15-6

3.16 Range Resources 3.16-1
3.16.1 Affected Environment 3.16-1
3.16.2 Environmental Consequences 3.16-2
3.16.3 Cumulative Impacts 3.16-5
3.16.4 Potential Monitoring and Mitigation Measures 3.16-6
3.16.5 Residual Impacts 3.16-8

3.17 Wildlife and Aquatic Biological Resources 3.17-1
3.17.1 Affected Environment 3.17-1
3.17.2 Environmental Consequences 3.17-17
3.17.3 Cumulative Impacts 3.17-26
3.17.4 Potential Monitoring and Mitigation Measures 3.17-29
3.17.5 Residual Impacts 3.17-33

3.18 Special Status Species 3.18-1
3.18.1 Affected Environment 3.18-1
3.18.2 Environmental Consequences 3.18-16
3.18.3 Cumulative Impacts 3.18-21
3.18.4 Potential Monitoring and Mitigation Measures 3.18-23
3.18.5 Residual Impacts 3.18-26

3.19 Land Use and Access 3.19-1
3.19.1 Affected Environment 3.19-1
3.19.2 Environmental Consequences 3.19-4
3.19.3 Cumulative Impacts 3.19-7
3.19.4 Potential Monitoring and Mitigation Measures 3.19-8
3.19.5 Residual Impacts 3.19-9

3.20 Noise 3.20-1
3.20.1 Affected Environment 3.20-1
3.20.2 Environmental Consequences 3.20-3
3.20.3 Cumulative Impacts 3.20-7
3.20.4 Potential Monitoring and Mitigation Measures 3.20-8
3.20.5 Residual Impacts 3.20-8

3.21 Environmental Justice 3.21-1
3.21.1 Affected Environment 3.21-1
3.21.2 Environmental Consequences 3.21-4
3.21.3 Cumulative Effects 3.21-5
3.21.4 Potential Monitoring and Mitigation Measures 3.21-6
3.21.5 Residual Impacts 3.21-6

3.22 Energy Requirements and Climate Change 3.22-1
3.22.1 Energy Requirements 3.22-1
3.22.2 Climate Change 3.22-1

3.23 Relationship between Short-term Uses of the Human Environment and the Maintenance and Enhancement of Long-term Productivity 3.23-1

3.24 Irreversible and Irretrievable Commitment of Resources 3.24-1

4.0 Consultation and Coordination 4-1
4.1 Public Participation and Scoping 4-1
4.1.1 Scoping 4-1
4.1.2 Public Review of the Draft EIS 4-2
4.2 Consultation and Coordination with Federal, State, and Local Agencies, and Tribes 4-2
4.3 List of Contacts 4-3
4.3.1 Federal Agencies 4-4
4.3.2 State Agencies 4-4
4.3.3 Elected Officials 4-5
4.3.4 Local Agencies 4-5
4.3.5 Tribal Organizations 4-6
4.3.6 Newspapers and Libraries 4-7
4.3.7 Private Organizations and Companies 4-7
4.3.8 Individuals 4-10

5.0 List of Preparers and Reviewers 5-1
5.1 Bureau of Land Management EIS Team 5-1
5.2 AECOM EIS Team (Third-party Consultant) 5-1
5.3 Barrick Dee Mining Venture Reviewers 5-2

6.0 References 6-1

List of Appendices

Appendix A - Reclamation Seed Mixes

Appendix B - Special Status Species Identified for the Arturo Mine Project

List of Tables

Table 1-1 Major Permits and Approvals 1-7

Table 2-1 Summary of Documents for the Dee Gold Mine 2-2

Table 2-2 Proposed Surface Disturbance 2-10

Table 2-3 Summary of Public and Private Land Proposed Disturbance by Facility 2-11

Table 2-4 Open Pit Ore and Waste Rock Summary 2-14

Table 2-5 Proposed Action Mining Schedule 2-14

Table 2-6 Proposed Action Waste Rock Disposal Facility Capacities and Heights 2-17

Table 2-7 Existing Heap Leach Pad of Material to be Excavated 2-22

Table 2-8 Solution Collection System Pond Sizing 2-25

Table 2-9 Primary Reagent, Chemical, and Fuel Usage 2-32

Table 2-10 Summary of Air Control Equipment 2-48

Table 2-11 Summary of Proposed Monitoring Plans 2-53

Table 2-12 Design Changes to Proposed Action to Address Arturo Mine Project Scoping Issues 2-54

Table 2-13 Single WRDF Alternative Waste Rock Disposal Facility Capacity and Height 2-56

Table 2-14 Surface Disturbance for Single WRDF Alternative 2-58

Table 2-15 Single Waste Rock Disposal Facility Alternative Schedule 2-58

Table 2-16 Partial Pit Backfill Alternative Waste Rock Disposal Facility Capacity and Height 2-61

Table 2-17 Partial Pit Backfill Alternative Mining Schedule 2-61

Table 3.1-1 Supplemental Authorities to be Considered 3.1-4

Table 3.1-2 Other Resources of the Human Environment 3.1-5

Table 3.2-1 Mining-related Surface Disturbance Associated with Past, Present, and RFFAs 3.2-4

Table 3.3-1 Active and Potentially Active Faults in the Region 3.3-10

Table 3.3-2 Recorded Earthquakes with Richter Magnitude of 5.0 or Greater Located Within 100-mile Radius of the Proposed Mine Site 3.3-11

Table 3.4-1 Hydrographic Basins Within the CESA for Water Resources 3.4-1

Table 3.4-2 Seeps and Other Features Within the Study Area 3.4-7

Table 3.4-3 Summary of Hydrostratigraphic Unit Properties 3.4-9

Table 3.4-4 General Nevada Water Quality Standards 3.4-15

Table 3.4-5 Water Quality Summary for Sampled Surface Drainage Locations within and near the Project Area 3.4-17

Table 3.4-6 Acid-based Accounting Test Results Summary for Waste Rock to be Placed in the WRDFs 3.4-19

Table 3.4-7 Meteoric Water Mobility Results for Representative Material Sources 3.4-21

Table 3.4-8 Average NNP of Rock Materials Exposed in the Pit Walls in the Existing and Proposed Open Pit 3.4-23

Table 3.4-9 Active Water Rights Located in the Vicinity of the Proposed Project 3.4-24

Table 3.4-10 Predicted Pit Lake Development Summary for the Proposed Action and Alternatives ... 3.4-31
Table 3.4-11 Predicted Water Quality of Outflow from the Pits Prior to Permanent Development of Pit Lakes ... 3.4-35
Table 3.4-12 Model-predicted Pit Lake Water Chemistry at Year 400 ... 3.4-39
Table 3.4-13 Estimated Waste Rock Generated by Proposed Action Mining ... 3.4-40
Table 3.4-14 Predicted Water Quality of Outflow from the Pit Prior to Permanent Development of a Permanent Pit Lake: Partial Pit Backfill Alternative ... 3.4-48
Table 3.5-1 Historic Properties within and Adjacent to the PoO Boundary and Along the Bootstrap Haul Road ... 3.5-5
Table 3.6-1 Summary of Native American Consultation for the Arturo Project EIS (Consultation is Ongoing) ... 3.6-4
Table 3.7-1 Waste Generated and Estimated Annual Quantities ... 3.7-4
Table 3.8-1 Monthly Climate Summary Elko WB Airport, Nevada ... 3.8-3
Table 3.8-2 Arturo Mine Precipitation Data 2002 - 2004 ... 3.8-5
Table 3.8-3 National and State of Nevada Ambient Air Quality Standards ... 3.8-6
Table 3.8-4 Annual Emissions from the Proposed Action for PoO Area ... 3.8-11
Table 3.8-5 Highest Modeled Air Pollutant Concentrations from the Proposed Action for PoO Area ... 3.8-13
Table 3.8-6 Estimated Maximum Potential Annual Emissions from Ore Haulage to BGMI – Proposed Action ... 3.8-14
Table 3.8-7 Arturo Ore as a Percentage of Total Ore Processed at BGMI ... 3.8-14
Table 3.8-8 $PM_{2.5}$ Emissions from Processing Arturo Ore at BGMI for Each Mine Year ... 3.8-15
Table 3.8-9 Annual $PM_{2.5}$ Emissions from Arturo Ore Processed at BGMI as a Percent of Total $PM_{2.5}$ Emissions at BGMI ... 3.8-15
Table 3.8-10 Estimated Ore Throughput by Process and Resultant Mercury Emissions from Processing Arturo Ore at BGMI ... 3.8-17
Table 3.8-11 Highest Modeled Air Pollutant Concentrations from the Single WRDF Facility Alternative ... 3.8-18
Table 3.8-12 Summary of Emission Sources Included in Air Quality Modeling ... 3.8-19
Table 3.9-1 Potential Fossil Yield Classification ... 3.9-3
Table 3.10-1 Population Characteristics ... 3.10-1
Table 3.10-2 Race and Ethnicity by County ... 3.10-3
Table 3.10-3 Nonagricultural Wage and Salary Employment by Sector ... 3.10-4
Table 3.10-4 2010 Housing Vacancy Rates ... 3.10-5
Table 3.10-5 Public Schools Enrollment History – Elko County School District ... 3.10-7
Table 3.10-6 County and City Budgets Fiscal Year 2009-2010 ... 3.10-8
Table 3.10-7 Arturo Mine Project Employment by Year ... 3.10-11
Table 3.10-8 New Construction-related Employment, Households, and Population Projections ... 3.10-12

Table 3.10-9 Proposed Action - New Operations-related Employment, Households, and Population Projections 3.10-13

Table 3.10-10 Partial Pit Backfill Alternative Employment by Year 3.10-17

Table 3.10-11 Partial Pit Backfill Alternative - New Operations-related Employment, Households, and Population Projections....3.10-18

Table 3.10-12 Actual and Projected Employment for Residents of Elko MSA at Mine Facilities in Carlin Trend and TS Power Plant....3.10-21

Table 3.12-1 BLM Visual Resource Management Class Objectives 3.12-1

Table 3.13-1 Study Area Soils....3.13-5

Table 3.13-2 Soil Limitations Associated with the Bootstrap Haul Road (acres) 3.13-7

Table 3.14-1 General Vegetation Cover and Land Use Types, Specific Vegetation Types, and Ecological Sites within the Study Area 3.14-2

Table 3.14-2 Riparian Zones and Wetland Areas Within the Study Area....3.14-9

Table 3.14-3 Proposed Action – Disturbed Acres of General Vegetation Cover and Land Use Types, and Specific Vegetation Types 3.14-11

Table 3.14-4 Proposed Action – Disturbed Acres of Wetlands within the Study Area 3.14-12

Table 3.14-5 Single WRDF Alternative – Disturbed Acres of General Vegetation Cover and Land Use Types, and Specific Vegetation Types 3.14-13

Table 3.15-1 State of Nevada Noxious Weeds....3.15-1

Table 3.16-1 Grazing Allotments in the Study Area and CESA 3.16-1

Table 3.16-2 Potential Impacts by Allotment 3.16-2

Table 3.17-1 Mines Impacting the Mule Deer Migration Corridor 3.17-9

Table 3.17-2 Inventory of Migratory and Resident Bird Species Potentially Occurring within the Study Area 3.17-13

Table 3.17-3 Cumulative Wildlife, Mule Deer, Pronghorn, and Elk Habitat Disturbance 3.17-28

Table 3.18-1 Cumulative Special Status Species Habitat Disturbance 3.18-22

Table 3.19-1 Land Use Authorizations and ROWs in the Study Area 3.19-3

Table 3.20-1 Typical Values of Sound Level of Common Noise Sources....3.20-3

Table 3.20-2 Arturo Mine Project Equipment Roster....3.20-5

Table 3.21-1 2010 Race and Ethnicity Percent by County....3.21-3

Table 3.22-1 Estimated Fuel and Electrical Power Consumption....3.22-2

Table 3.24-1 Irreversible and Irretrievable Commitment of Resources by the Proposed Action..3.24-2

Table 4-1 Scoping Comments Distribution 4-2

List of Figures

Figure 1-1 Project Location 1-2
Figure 1-2 Land Status 1-4
Figure 2-1 Existing Facilities at Dee Gold Mine 2-4
Figure 2-2 Proposed Disturbance 2-8
Figure 2-3 Proposed Ore Processing and Plant Facilities 2-9
Figure 2-4 Proposed Action Typical Cross-sections of Open Pit with Final Slopes 2-13
Figure 2-5 Proposed Action Typical Cross-sections of the West WRDF and Open Pit with Reclaimed Slopes 2-18
Figure 2-6 Proposed Action Typical Cross-sections of the East WRDF and Open Pit with Reclaimed Slopes 2-19
Figure 2-7 Simplified Schematic of the Ore Processing Circuit 2-21
Figure 2-8 Typical Heap Leach Pad Cross-sections with Reclaimed Slopes 2-24
Figure 2-9 Typical Bootstrap Haul Road Cross-section 2-28
Figure 2-10 Proposed Project Schedule 2-35
Figure 2-11 Example Output of Reclamation Topography Design Software 2-38
Figure 2-12 Proposed Action Post-mining Reclamation Topography 2-39
Figure 2-13 Single WRDF Alternative 2-57
Figure 2-14 Single WRDF Alternative Post-mining Reclamation Topography 2-60
Figure 2-15 Partial Pit Backfill Alternative Typical Cross-sections of Open Pit with Reclaimed Slopes 2-63
Figure 2-16 Partial Pit Backfill Alternative Typical Cross-sections of the West WRDF with Reclaimed Slopes 2-64
Figure 2-17 Partial Pit Backfill Alternative Typical Cross-sections of the East WRDF with Reclaimed Slopes 2-65
Figure 2-18 Partial Pit Backfill Post-mining Reclamation Topography 2-66
Figure 2-19 No Action Alternative Reclamation Topography 2-68
Figure 3.1-1 General Setting 3.1-3
Figure 3.2-1 Mine Disturbance Carlin Trend in Nevada 3.2-2
Figure 3.2-2 Past, Present, and Reasonably Foreseeable Future Mining Actions Carlin Trend in Nevada 3.2-3
Figure 3.2-3 Fire History in the Vicinity of Carlin Trend 1980-2011 ....3.2-11
Figure 3.2-4 Recent Seeding in the Vicinity of the Carlin Trend 3.2-13
Figure 3.3-1 Geology and Minerals Cumulative Effects Study Area 3.3-2
Figure 3.3-2 Regional Geologic Map 3.3-3
Figure 3.3-3 Geologic Map Arturo Mine Study Area 3.3-5
Figure 3.3-4 Geologic Cross-sections Arturo Mine Study Area 3.3-6
Figure 3.3-5 Stratigraphic Column of Paleozoic Sequence 3.3-7

Figure 3.4-1 Water Resources Cumulative Effects Study Area 3.4-3
Figure 3.4-2 Water Features in and Near the Study Area 3.4-4
Figure 3.4-3 Streams, Springs, and Seeps Within the Cumulative Effects Study Area 3.4-6
Figure 3.4-4 Regional Groundwater Elevation (First Quarter 2010) 3.4-13
Figure 3.4-5 Changes in Regional Groundwater Elevation (1990-2010) 3.4-14
Figure 3.4-6 Active Water Rights Located in the Vicinity of the Study Area 3.4-25
Figure 3.4-7 Comparison of Predicted Rate of Filling for the Existing Dee Pit and the Proposed Arturo Pit 3.4-29
Figure 3.4-8 Post-mining Pit Lakes Proposed Action 3.4-30
Figure 3.4-9 Predicted Trends in pH for the South, North, and East Pit Lakes (Proposed Action) and Existing Pit (No Action) 3.4-33
Figure 3.4-10 Predicted Trends in TDS for the South, North, and East Pit Lakes (Proposed Action) and Existing Pit (No Action) 3.4-34
Figure 3.4-11 WRDF Schematic Cross-section Showing Encapsulation of Environmentally Adverse Waste Rock 3.4-41
Figure 3.4-12 Post-mining Pit Lake Partial Pit Backfill Alternative 3.4-47
Figure 3.4-13 Post-mining Pit Lake No Action 3.4-50
Figure 3.5-1 Cultural Resources Cumulative Effects Study Area 3.5-3
Figure 3.6-1 Native American Traditional Values Cumulative Effects Study Area 3.6-3
Figure 3.7-1 Hazardous Materials/Solid Waste Study Area and Cumulative Effects Study Area..3.7-2
Figure 3.8-1 Air Quality Cumulative Effects Study Area 3.8-2
Figure 3.8-2 5-Year Composite Wind Rose Plot for Elko, Nevada 3.8-4
Figure 3.9-1 Paleontological Resources Cumulative Effects Study Area 3.9-2
Figure 3.10-1 Social and Economic Values Cumulative Effects Study Area 3.10-2
Figure 3.11-1 Recreation and Wilderness Cumulative Effects Study Area 3.11-2
Figure 3.12-1 Visual Resources Cumulative Effects Study Area and Key Observation Points 3.12-2
Figure 3.12-2 Key Observation Points and VRM Classifications 3.12-3
Figure 3.12-3 Key Observation Point 1 Visual Simulations 3.12-7
Figure 3.12-4 Key Observation Point 2 Visual Simulations 3.12-8
Figure 3.12-5 Key Observation Point 3 Visual Simulations 3.12-9
Figure 3.12-6 Key Observation Point 4 Visual Simulations 3.12-10
Figure 3.12-7 Key Observation Point 5 Visual Simulations 3.12-11
Figure 3.13-1 Soils and Reclamation Cumulative Effects Study Area 3.13-2
Figure 3.13-2 Soil Types Within the Study Area 3.13-3
Figure 3.13-3 Fire History Within the Cumulative Effects Study Area 3.13-11
Figure 3.14-1 Vegetation Cumulative Effects Study Area 3.14-3
Figure 3.14-2 Riparian Zones and Wetland Areas Cumulative Effects Study Area 3.14-4
Figure 3.14-3 Vegetation Cover and Land Use Types Within the Study Area 3.14-5

Figure 3.14-4 Seeps, Riparian Zones, and Wetlands Within the Study Area 3.14-8
Figure 3.15-1 Noxious Weeds and Invasive Species Cumulative Effects Study Area 3.15-3
Figure 3.16-1 Range Resources Cumulative Effects Study Area 3.16-3
Figure 3.16-2 Proposed Range Fence Mitigation Measure 3.16-7
Figure 3.17-1 Wildlife Cumulative Effects Study Area 3.17-3
Figure 3.17-2 Mule Deer Cumulative Effects Study Area 3.17-4
Figure 3.17-3 Pronghorn Cumulative Effects Study Area 3.17-5
Figure 3.17-4 Elk Cumulative Effects Study Area 3.17-6
Figure 3.17-5 Aquatic Biological Cumulative Effects Study Area 3.17-7
Figure 3.17-6 Mule Deer Habitat in the Study Area 3.17-8
Figure 3.17-7 Pronghorn Habitat in the Study Area 3.17-10
Figure 3.17-8 Elk Habitat in the Study Area 3.17-11
Figure 3.17-9 Mule Deer Habitat Treatment Areas 3.17-31
Figure 3.18-1 Special Status Wildlife Species Cumulative Effects Study Area 3.18-3
Figure 3.18-2 Greater Sage-grouse Habitat Cumulative Effects Study Area 3.18-4
Figure 3.18-3 Greater Sage-grouse PPH and PGH in the Study Area and Cumulative Effects Study Area 3.18-5
Figure 3.18-4 Special Status Aquatic Species Cumulative Effects Study Area 3.18-6
Figure 3.18-5 Greater Sage-grouse Habitat in the Study Area 3.18-12
Figure 3.18-6 Greater Sage-grouse PPH and PGH in the Study Area 3.18-13
Figure 3.18-7 Greater Sage-grouse Treatment Areas 3.18-25
Figure 3.19-1 Land Use and Access Cumulative Effects Study Area 3.19-2
Figure 3.20-1 Noise Cumulative Effects Study Area 3.20-2
Figure 3.21-1 Environmental Justice Cumulative Effects Study Area 3.21-2

1.0 Introduction

1.1 Introduction and General Location

Barrick-Dee Mining Venture (BDMV) proposes to construct, operate, and reclaim the Arturo Mine Project (Proposed Action/project), which would include development of new facilities and expansion of previously disturbed gold mining areas at the Dee Gold Mine. The proposed project is located on the northern end of the Carlin Trend in Elko County, Nevada, approximately 27 aerial miles northwest of the town of Carlin, as shown in **Figure 1-1**. The proposed project is located on public land administered by the United States Department of the Interior, Bureau of Land Management (BLM), Elko District, Tuscarora Field Office.

The proposed project would be an expansion of the existing Dee Gold Mine, which was operated by the Dee Gold Mining Company under Plan of Operations (PoO) NVN-070250; the Dee Gold Mine currently is in reclamation and closure. The project is proposed by BDMV, a joint venture between Barrick Gold Exploration Inc., the venture manager, and Marigold Mining Company, a subsidiary of Goldcorp Inc.

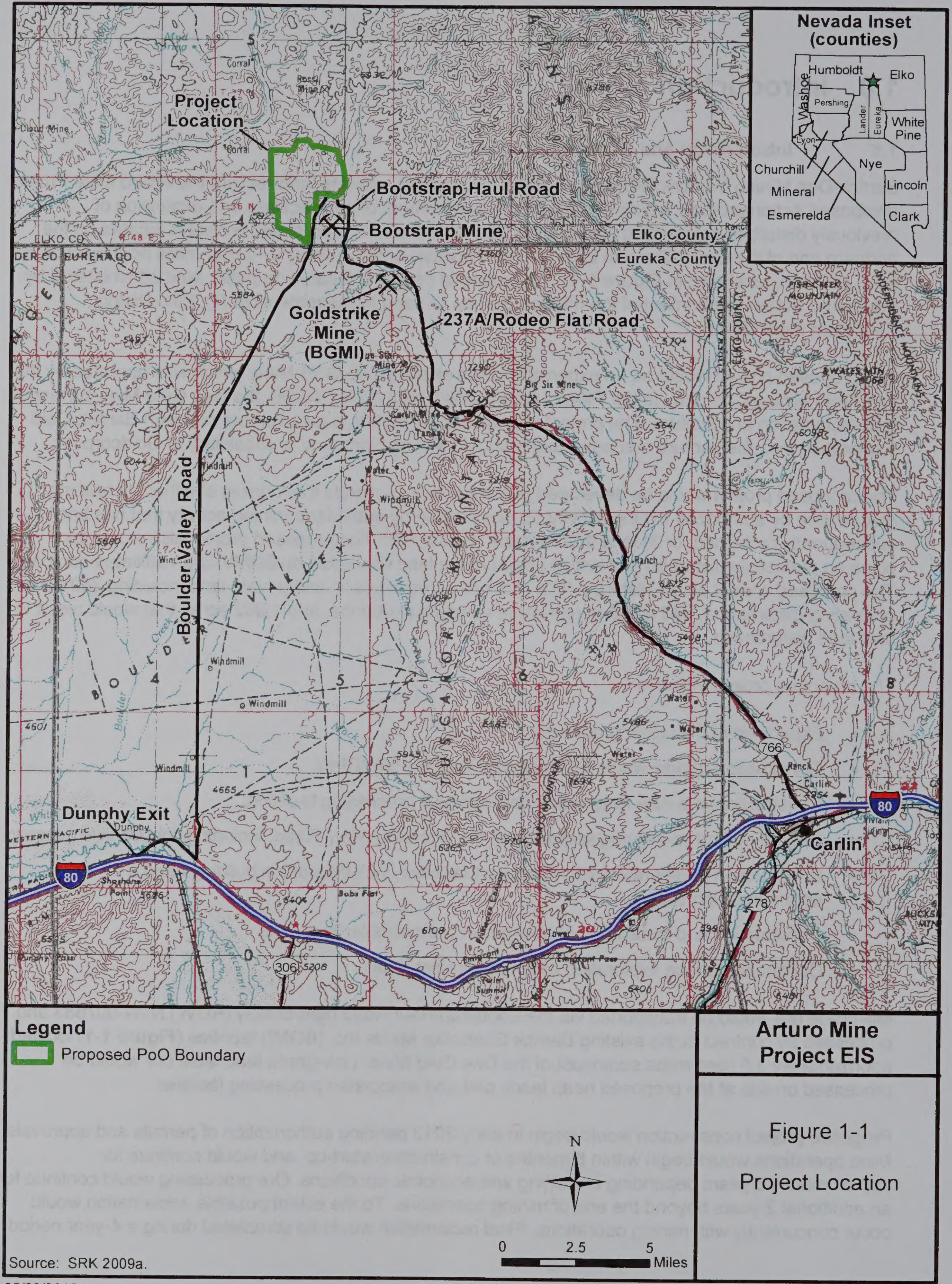
The proposed project would be developed primarily on public lands that consist of either: 1) existing disturbance by authorized mining activity, 2) disturbance by authorized mining activity that has been subsequently reclaimed, or 3) land that remains undisturbed. The proposed project also would take place on previously disturbed and undisturbed private land controlled by BDMV or an affiliated company. The proposed project would disturb a total of 2,774 acres of public and private land including 269 acres of existing disturbance, 543 acres of reclaimed mining disturbance, and 1,962 acres that would result in new land disturbance.

The proposed project includes:

- Expansion of the existing open pit;
- Construction of new waste rock disposal facilities (WRDFs);
- Construction of a new heap leach pad and gold processing facilities;
- Upgrading and re-aligning segments of the Bootstrap Haul Road, including light vehicle access;
- Construction and/or relocation of support facilities, including office buildings and a communication site;
- Construction and installation of new power transmission lines; and
- Continued surface exploration within the project area.

Mill-grade ore would be transported via the Bootstrap Haul Road right-of-way (ROW) NVN-007683 and processed by contract at the existing Barrick Goldstrike Mines Inc. (BGMI) facilities (**Figure 1-1**) located approximately 3.5 road miles southeast of the Dee Gold Mine. Low-grade leachable ore would be processed on-site at the proposed heap leach pad and associated processing facilities.

Proposed project construction would begin in early 2013 pending authorization of permits and approvals. Mine operations would begin within 8 months of construction start-up, and would continue for approximately 8 years depending on mining and economic conditions. Ore processing would continue for an additional 2 years beyond the end of mining operations. To the extent possible, reclamation would occur concurrently with mining operations. Final reclamation would be completed during a 4-year period



Arturo Mine Project EIS

Figure 1-1

Project Location

Source: SRK 2009a.

05/22/2012

following cessation of mining. Post-closure monitoring by the Nevada Division of Environmental Protection (NDEP)-Bureau of Mining Regulation and Reclamation (BMRR) may continue for up to 30 years following completion of processing according to current regulations. The duration of the BLM's post-closure monitoring would depend on the project's final closure plan and its implementation.

The proposed project would be located in Elko County, within the United States Geological Survey Santa Renia Fields' 7.5-minute topographic quadrangle map area. The proposed PoO boundary, within which most of the mining facilities and activities are proposed, consists of unpatented mining claims located on public land administered by the BLM. Other proposed elements of the project area (Bootstrap Haul Road, power connection yard, power transmission line corridor, and a portion of the secondary access road entrance) would be located on a combination of BLM land and private land. **Figure 1-2** provides an overview of the surface land ownership of the proposed project area.

BLM approval is required for activities that occur on public lands pursuant to the Federal Land Policy and Management Act of 1976 (FLPMA) (as amended), the BLM's surface management regulations (43 Code of Federal Regulations [CFR] Subpart 3809), and the BLM's regulations pertaining to use and occupancy under the mining laws (43 CFR Subpart 3715). The BLM also is required by the National Environmental Policy Act of 1969 (NEPA) to review the impacts of the overall proposal, including impacts on both public and private lands. The BLM has determined that an Environmental Impact Statement (EIS) must be prepared to fulfill the NEPA requirements.

Subpart 3715 of 43 CFR identifies the requirements for "use and occupancy of public lands for the development of locatable mineral deposits by restricting such use or occupancy to that which is reasonably incident." BDMV is required to meet the specific conditions outlined in 43 CFR Subpart 3715.3-2, as the Proposed Action would disturb a total of 2,703 acres of public land administered by the BLM.

The proposed PoO boundary would be fenced and/or signed to restrict public access. Access to the proposed PoO boundary would require permission from BDMV in order to protect the public from potentially hazardous situations and to protect the mine facilities and equipment from vandalism or damage. Fences and signs would be approved by the BLM. The occupancy and use requirements of this PoO do not allow individuals to live on-site.

Areas where facilities would be located outside the main PoO boundary, which include the proposed Bootstrap Haul Road, power connection yard, power transmission line corridor, and secondary access road generally would be open to public access. Fencing and signage required in these areas to protect the public from hazards and to protect BDMV property would be approved by the BLM.

A programmatic Environmental Assessment (EA) for mining claim, mill site use, and occupancy for selected actions was completed by the BLM for the State of Nevada with a finding of no significant impact (BLM 2000a). The programmatic EA provides the basic analysis for the proposed use and occupancy of public lands. This EIS provides the site-specific analysis for the proposed project.

The BLM is serving as the lead agency for preparing the EIS in compliance with NEPA, the Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR 1500-1508), the BLM's NEPA Handbook (H-1790-1), the Bureau-wide Guidelines for Assessing and Documenting Cumulative Impacts (April 1994), CEQ's Considering Cumulative Effects under NEPA (January 1997), and other applicable guidance. The Nevada Department of Wildlife (NDOW) and the Elko County Board of Commissioners are serving as cooperating agencies for preparation and review of this EIS.

This EIS describes and analyzes the environmental consequences of the Proposed Action and proposed project alternatives, including the No Action Alternative. The No Action Alternative is to continue surface exploration activities and complete reclamation and closure activities of the Dee Gold Mine, as currently authorized.

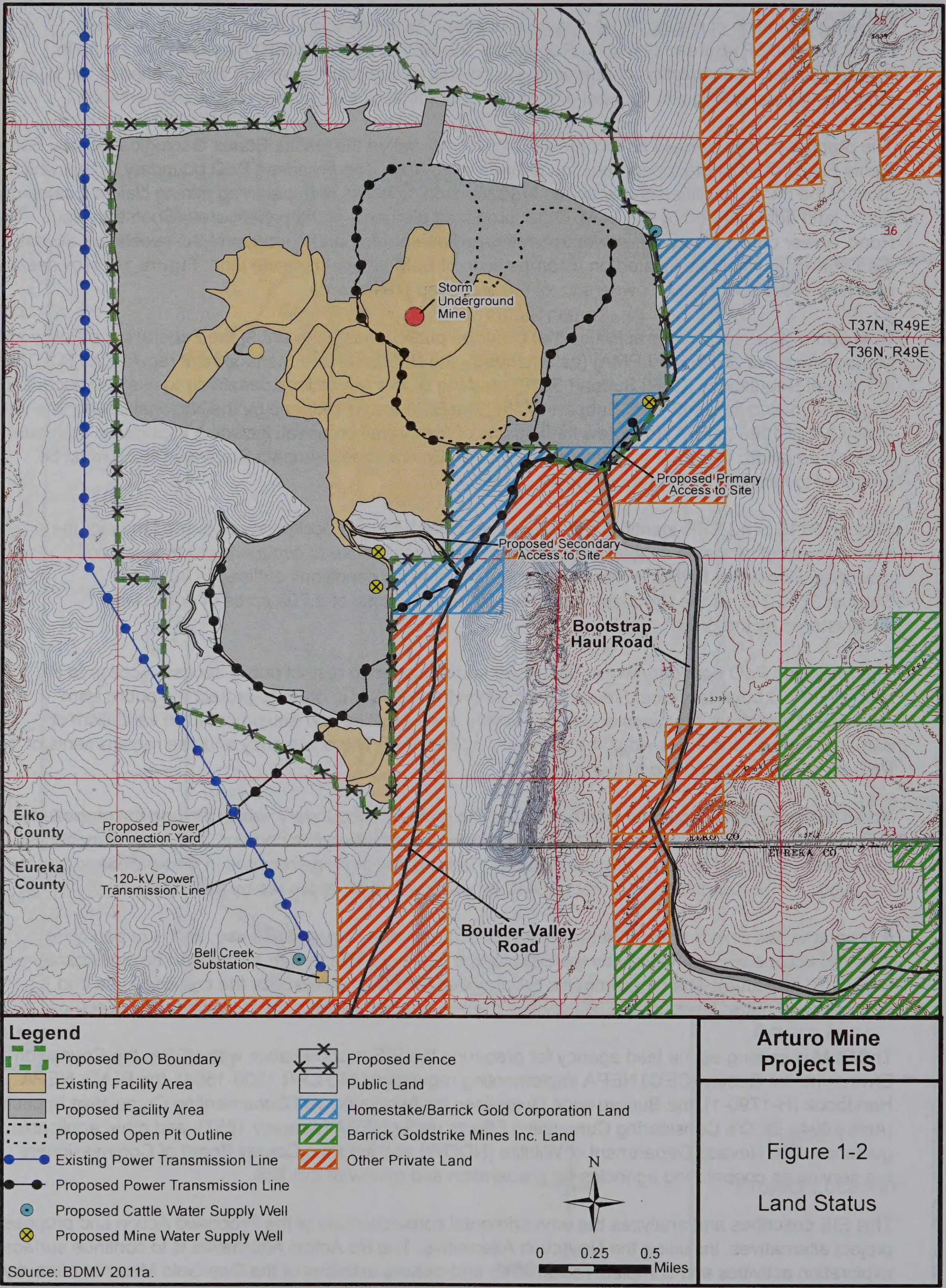

Storm Underground Mine
T37N, R49E
T36N, R49E
Proposed Primary Access to Site
Proposed Secondary Access to Site
Bootstrap Haul Road
Boulder Valley Road
Elko County
Eureka County
Proposed Power Connection Yard
120-kV Power Transmission Line
Bell Creek Substation
ELKO CO
EUREKA CO
Legend
Proposed PoO Boundary
Existing Facility Area
Proposed Facility Area
Proposed Open Pit Outline
Existing Power Transmission Line
Proposed Power Transmission Line
Proposed Cattle Water Supply Well
Proposed Mine Water Supply Well
Proposed Fence
Public Land
Homestake/Barrick Gold Corporation Land
Barrick Goldstrike Mines Inc. Land
Other Private Land
N
0
0.25
0.5
Miles
Arturo Mine Project EIS

Figure 1-2

Land Status

Source: BDMV 2011a.

05/29/2012

1.2 Current Status of the Dee Gold Mine

The Arturo Mine Project is a proposed expansion of the Dee Gold Mine, an existing open-pit mine undergoing reclamation and closure. The Dee Gold Mine started open-pit production in 1983. In 1999, the Dee Gold Mine began underground production from a decline in the bottom of the open pit. The open-pit and underground operations were shut down in 2000 (a period of low gold prices) at which time, reclamation and closure activities were initiated at the Dee Gold Mine. In 2006, Barrick-Rossi Mining Venture began construction and operation of the Storm Underground Mine from a second decline in the bottom of the Dee open pit. The existing facility area is shown in **Figure 1-2**. Most of the facilities associated with the Dee Gold Mine have been reclaimed and bond released for earth work and revegetation except for those facilities that support the Storm Underground Mine.

1.3 History of Plans of Operation and Rights-of-Way Associated with the Dee Gold Mine

There have been a number of permitted disturbances within the proposed project area as a result of gold exploration and mining over the last 3 decades, the most significant of which are discussed below.

Cordex Exploration Company conducted exploration activities under PoO NVN-070509 within the project area from 1981 to 1983. Dee Gold Mining Company obtained control of the mining claims in the project area in 1983. Beginning in 1983, Dee Gold Mining Company explored and operated in the area under the Dee Gold Mine PoO NVN-070250 and a series of plan amendments as analyzed in EAs (EA-NV-010-83-053, EA-NV-010-91-101, BLM/EK/PL-93/035, and BLM/EK/PL-97/003). The NDEP-BMRR Reclamation Permit associated with this PoO is No. 0118.

Since 1998, BDMV has conducted exploration activities on the property under the Dee Surface Exploration PoO NVN-071216 and NDEP-BMRR Reclamation Permit No. 0142. Barrick Meridian Joint Venture conducts exploration within the project boundary under the Rossi Surface Exploration Project PoO NVN-070874 and NDEP-BMRR Reclamation Permit No. 0183.

Barrick-Rossi Mining Venture conducts underground mining and exploration operations from the Dee open pit under the approved Storm Underground Mine PoO NVN-071238 and NDEP-BMRR Reclamation Permit No. 0243.

ROWs associated with the proposed project include the Bootstrap Haul Road (NVN-007683), the Sierra Pacific Power Company/NVEnergy 69-kilovolt power transmission line to the Dee Gold Mine (NVN-038874), and the Sierra Pacific Power Company/NVEnergy 120-kilovolt power transmission line (NVN-053160).

1.4 Purpose and Need for Action

The BLM's purpose is to respond to BDMV's proposed Arturo Mine Project PoO, including the proposed changes to the Bootstrap Haul Road and the power transmission line ROWs. BDMV is proposing to expand and develop an open-pit mine on public lands to mine gold and silver, which are locatable minerals, and to construct a power transmission line to provide electricity to this mining operation. The Bootstrap Haul Road would be widened to allow transportation of ore by haul truck to the existing BGMI milling facility. In responding to BDMV's proposed project, the BLM would determine whether to approve, approve with modifications, or deny the proposed project.

The BLM's need for the action is based on BDMV's proposed project. The BLM is required to respond to BDMVs proposed project to conduct mining operations for locatable minerals in accordance with the Surface Management Regulations (43 CFR 3809), the Use and Occupancy Under the Mining Laws Regulations (43 CFR 3715), and other applicable laws such as FLPMA and NEPA. The BLM is required to respond to BDMV's proposal to construct a power transmission line and to upgrade the Bootstrap Haul Road in accordance with the BLM ROW Regulations (43 CFR 2800), and respond to the ROW application under Title V of FLPMA for a ROW grant to construct, operate, maintain, and decommission this proposed power transmission line and reclaim the proposed Bootstrap Haul Road. In considering the need for the proposed project, the BLM must determine if the proposed project would create unnecessary or undue degradation of the public lands involved in the action. The NEPA mandates that the BLM evaluate or analyze the environmental impacts of the proposed project and reasonable alternatives (including the No Action Alternative), and consider and evaluate appropriate mitigation measures.

1.5 Relationship to BLM and Non-BLM Policies, Plans, and Programs

1.5.1 Land Use Plan Conformance

The BLM has the responsibility and authority to manage the surface and subsurface resources on public lands located within the BLM's jurisdiction, and has designated the lands within the project area as open to entry for locatable minerals.

The Proposed Action and alternatives described in this document are in conformance with the Elko Resource Management Plan, Issue – Minerals, Management Prescription – 1 (BLM 1987) and are consistent with federal, state, and local laws, regulations, and plans.

1.5.2 State and Local Land Use Plans and Policies

The State of Nevada's 1986 Statewide Policy Plan for Public Lands section on Mineral Resources states the Goals for Mineral Resources as: recognize that the development of Nevada's mineral resources is desirable and necessary to the nation, the state, and particularly, to the rural counties of the state; retain existing mining areas and promote the expansion of mining operations and areas, while respecting other resource values; and develop policies and regulations that provide for the long-term availability and responsible development of Nevada's mineral resources (Nevada Division of State Lands 1986).

The State of Nevada recognizes that mining is an important contributor to the state's economy and encourages the development of mineral resources. In Nevada Revised Statute 519A.010, the state policy toward mining and reclamation as defined by the Legislature is:

> "(a) The extraction of minerals by mining is a basic and essential activity making an important contribution to the economy of the State of Nevada;
>
> (b) Proper reclamation of mined land, areas of exploration and former areas of mining or exploration is necessary to prevent undesirable land and surface water conditions detrimental to the ecology and to the general health, welfare, safety and property rights of the residents of this state; and
>
> (c) The success of reclamation efforts in this state is dependent upon cooperation among state and federal agencies."

Elko County, in cooperation with the Nevada Division of State Lands, developed the Elko County Public Land Use and Natural Resource Management Plan (Elko County 2010). The Proposed Action is consistent with this plan that recognizes the economic importance of developing mineral resources within the county. Directive 14-1 states that it is the objective/goal of the Elko County Public Land Use and Natural Resource Management Plan to "…retain existing mining areas and promote the expansion of mining operations and areas not specifically withdrawn" (Elko County 2010).

The Proposed Action is consistent with state and local land use plans and policies.

1.6 Environmental Review Process

Numerous opportunities for public input occur during the NEPA decision-making process. The initial step in the EIS process is to notify the public and other government agencies of the BLM's intent to prepare an EIS. The BLM published a Notice of Intent to prepare an EIS for the proposed project in the Federal

Register (FR) on June 21, 2010. The Notice of Intent included a summary of the proposed project, information on public scoping, and project contact information.

The purpose of public scoping is to actively solicit and acquire input from the public and other interested federal, state, tribal, and local agencies about the proposed project. Information received during public scoping helps the agencies identify potential environmental issues, social, economic, cultural issues/impacts, alternatives, and mitigation measures associated with the development of the proposed project. The process provides a mechanism for focusing and clarifying the issues so the EIS can address and analyze the primary areas of concern. Section 4.1, Public Participation and Scoping, provides detailed information regarding public scoping that was conducted for the proposed project.

After completion of the public scoping period, the Draft EIS is prepared, which addresses the environmental effects associated with the Proposed Action and alternatives, including the issues and concerns identified during the scoping process. After the Draft EIS is published through a Notice of Availability in the FR, the public has the opportunity to comment on the EIS during a 45-day public comment period. During the public comment period, the BLM conducts one or more public meetings. Comments can be submitted at the public meetings by filling out comment forms. The public also may submit comments to the BLM via mail, facsimile, and e-mail. The e-mail address for comments is BLM_NV_ELDOArturoEISTeam@BLM.gov.

The Final EIS includes responses to all substantive public comments received on the Draft EIS. The Final EIS is published through a Notice of Availability in the FR, and the public has the opportunity to review the Final EIS for a 30-day review period. Following the 30-day review period, the BLM issues the Record of Decision for the EIS.

1.7 Project Permits and Approvals

In addition to the EIS, implementing the Proposed Action would require authorizing actions from other federal, state, and local agencies with jurisdiction over certain aspects of the proposed project. **Table 1-1** lists the required permits or approvals, which are already in place or that would be obtained or otherwise addressed, and the responsible regulatory agencies. BDMV is responsible for amending existing permits and applying for and acquiring additional permits, as needed.

Table 1-1 Major Permits and Approvals

Permit/Approval	Granting Agency
EIS PoO Approval ROW Grant(s)	BLM
Explosives Permit	United States Bureau of Alcohol, Tobacco, and Firearms
Section 106 National Historic Preservation Act agreement document(s)	BLM and State of Nevada Historic Preservation Office
National Pollutant Discharge Elimination System Storm Water General Permit	NDEP-Bureau of Water Pollution Control
Water Pollution Control Permit Reclamation Permit	NDEP-BMRR
Permit to Appropriate Water – Change in Point of Use and Diversion	Nevada Division of Water Resources (NDWR)
Nevada State Dam Permit (storm water ponds)	NDWR

Table 1-1 Major Permits and Approvals

Permit/Approval	Granting Agency
Industrial Artificial Pond Permit	NDOW
Approval to Operate a Sanitary Landfill/ Solid Waste System Hazardous Waste Management Permit	NDEP-Bureau of Waste Management
Air - Surface Disturbance Permit Air - Permit to Construct Air - Permit to Operate	NDEP-Bureau of Air Pollution Control
Hazardous Materials Permit	State of Nevada; Fire Marshal Division
Radioactive Material License	Nevada State Health Division – Radiological Health Section
Road Construction Applications Building Permits	County
Potable Water System	NDEP-Bureau of Safe Drinking Water
Septic System	NDEP-Bureau of Water Pollution Control

1.8 Summary of Key Issues

Major issues associated with the Proposed Action identified during the preparation of this EIS include:

- Potential long-term geotechnical stability of project components;
- Potential for degradation of surface water or groundwater quality from the placement of waste rock containing a mixture of oxide- and sulfide-bearing materials;
- Potential impacts associated with the quality of water discharged from the existing Tailings Disposal Facility 1 that would be covered with the proposed West WRDF;
- Potential construction, operation, and closure of a new heap-leach facility;
- Potential post-closure pit lake water quality and associated impacts;
- Potential mule deer migration corridor disruption due to the proposed WRDFs;
- Potential livestock management issues including cattle movement and loss of grazing areas;
- Potential social and economic impacts to affected communities with an average of more than 200 new jobs created for the 8-year construction and operation of the mine; and
- Potential air emissions impacts, including mercury.

1.9 Organization of the Environmental Impact Statement

This EIS follows the CEQ recommended organization (40 CFR 1502.10). Chapter 1.0 provides descriptions of the purpose and need for the action, the role of the BLM in the EIS process, and the required regulatory actions for the proposed project. Chapter 2.0 describes the Proposed Action and alternatives, including the No Action Alternative. Chapter 3.0 describes the affected environment and the direct, indirect, and cumulative impacts associated with the Proposed Action and alternatives; possible mitigation to reduce or minimize impacts; and any residual adverse effects following the implementation of mitigation. Chapter 4.0 summarizes public participation and the scoping process and the consultation and coordination undertaken to prepare the EIS. Chapter 5.0 presents the list of EIS preparers and reviewers. Chapter 6.0 presents the list of references. Copies of supporting documents are on file at the BLM Tuscarora Field Office in Elko, Nevada.

Industrial Artificial Pond Permit	NDOW
Approval to Operate a Sanitary Landfill Solid Waste System Hazardous Waste Management Permit	NDEP-Bureau of Waste Management
Air - Surface Disturbance Permit Air - Permit to Construct Air - Permit to Operate	NDEP-Bureau of Air Pollution Control
Hazardous Materials Permit	State of Nevada, Fire Marshal Division
Radioactive Materials License	Nevada State Health Division – Radiological Health Section
Road Construction Authorization, Business License	County
Potable Water System	NDEP-Bureau of Safe Drinking Water
Septic System	NDEP-Bureau of Water Pollution Control

1.8 Summary of Key Issues

[illegible] issues associated with the [illegible] identified during the preparation of the EIS include:

- Potential [illegible] to project components;
- Potential for degradation of surface water and groundwater quality from the placement of waste [illegible] leaching of materials;
- Potential changes to [illegible] water discharged from the existing Tailings [illegible] and the proposed West WRDF;
- Potential [illegible] heap leach facility;
- Potential [illegible] and associated impacts;
- Potential [illegible] to the proposed WRDFs;
- Potential impacts to [illegible] movement and loss of grazing areas;
- Potential [illegible] communities with an average of more than [illegible] of the mine; and
- Potential [illegible].

1.9 Organization of the Environmental Impact Statement

This EIS follows the CEQ recommended format (40 CFR 1502.10). Chapter 1.0 provides descriptions of the purpose and need for the [illegible] in the EIS process, and the required regulatory actions for the proposed project. Chapter 2.0 describes the Proposed Action and alternatives, including the No Action Alternative. Chapter 3.0 describes the affected environment and the direct, indirect, and cumulative impacts associated with the Proposed Action and alternatives, possible mitigation to reduce or eliminate impacts, and unavoidable adverse effects following the implementation

2.0 Description of Alternatives Including the Proposed Action

2.1 Introduction

This chapter describes the proposed Arturo Mine Project (Proposed Action/project) as described by Barrick-Dee Mining Venture (BDMV) in their Plan of Operations (PoO) and Reclamation Permit Application, Bureau of Land Management (BLM) File NVN-087946 (SRK Consulting [U.S.] Inc. [SRK] 2009a).

The Proposed Action is an open-pit mining project located at the existing Dee Gold Mine property. This chapter describes the proposed project alternatives, including the Proposed Action, alternative actions, and the No Action Alternative. This chapter also includes a summary of other alternatives that were considered but eliminated from detailed analysis. The BLM's preferred alternative is identified in Section 2.5, BLM-preferred Alternative.

Existing facilities and disturbance for the Dee Gold Mine and the Storm Underground Mine located within the proposed project area are described in this chapter. Unless otherwise indicated, elevations in this Environmental Impact Statement (EIS) correlate with United States Geological Survey feet above mean sea level (amsl).

2.2 Project Background

2.2.1 Ownership History

Exploration and mining activities have occurred in the vicinity of the project area for the past 30 years. Cordex Exploration Company conducted exploration activities in the project area from 1981 to 1983. Dee Gold Mining Company obtained control of the mining claims within the project area in 1983. In 1984, Dee Gold Mining Company, with Rayrock Mines Inc. as the mine operator, began open-pit gold production. In 1999, Dee Gold Mining Company began underground mining of the Dee Deep North deposit from a decline in the bottom of the open pit. The open pit and underground operations were subsequently shut down in 2000 due to a period of low gold prices. Reclamation and closure activities were initiated in 2000 on the heap leach pads, tailings disposal facilities, Waste Rock Disposal Facility (WRDF), and ancillary facilities.

Barrick Gold Exploration entered into an agreement with Dee Gold Mining Company and began exploration at the Dee Gold Mine in June of 1998. Glamis Gold Ltd. acquired Rayrock Mines Inc. in 1999. Barrick Gold Exploration Inc. and Glamis Marigold Mining Company, successor in interest to Dee Gold Mining Company, entered into an agreement in January 2005 and formed BDMV. Goldcorp Inc. acquired Glamis Gold Ltd. in 2006. In 2007, Goldcorp Inc. changed the name of Glamis Marigold Mining Company to Marigold Mining Company. The Proposed Action considered in this EIS is proposed by BDMV, the mining venture between Barrick Gold Exploration Inc. and Marigold Mining Company. Barrick Gold Exploration Inc. is the manager of the Arturo Mine Project.

As a separate entity, Barrick Rossi Mining Venture (a mining venture between Barrick Gold Exploration Inc. and Meridian Rossi Corporation) began the Storm Underground Mine from a second decline in the bottom of the Dee Gold Mine open pit in 2006. In 2008, Barrick Storm Inc. acquired the Meridian Rossi Corporation interest. The Storm Underground Mine operation is responsible for reclamation of disturbance associated with its operation. At this time, some facilities of the Dee Gold Mine have not been reclaimed because they support the operation of the Storm Underground Mine. Additionally, various Storm Underground Mine facilities are located within the Proposed Action open-pit boundary as discussed in Section 2.2.3.2, Storm Underground Mine. The Storm Underground Mine and the proposed

Arturo Mine Project would continue to operate as separate projects managed and coordinated by Barrick Gold Exploration Inc.

2.2.2 Permitting History

Table 2-1 provides a summary of documents associated with the existing Dee Gold Mine.

Table 2-1 Summary of Documents for the Dee Gold Mine

Plan/Permit/ NEPA[1] Document No.	Date	Original Entity	Description	Status/Notes
NVN-070509	1981	Cordex Exploration Company	PoO for surface Exploration.	Closed PoO. Project advanced to mine PoO NVN-070250.
EA-NV-010-81-070	1981	BLM document	Cordex Exploration PoO Environmental Assessment (EA).	--
NVN-070250 and Nevada Division of Environmental Protection (NDEP)-Bureau of Mining Regulation and Reclamation (BMRR) Permit No. 0118	1983	Dee Gold Mining Company	Dee Gold Mine PoO for surface exploration and open pit mining. Underground mining operations also were conducted under this PoO. Created 812 acres of surface disturbance.	Closure and reclamation activities in progress.
EA-NV-010-83-053	1983	BLM document	Dee Gold Mine PoO EA.	--
EA-NV-010-91-101	1991	BLM document	Dee Gold Mine Expansion Project EA.	--
BLM/EK/PL-93/035	1993	BLM document	Dee Gold Mine Expansion Project II EA.	--
BLM/EK/PL-97/003	1997	BLM document	Dee Gold Mine Expansion Project III EA.	--
NVN-070874 and NDEP-BMRR Reclamation Permit No. 0183	1991	Barrick Meridian Joint Venture	Rossi Surface Exploration Project PoO. Approved for 51 acres of surface disturbance.	Active surface exploration project.
EA-NV-010-91-059	1991	BLM document	Rossi Surface Exploration Project EA.	--
NVN-071216 and NDEP-BMRR Reclamation Permit No. 0142	1998	Barrick Gold Exploration Inc.	Dee Surface Exploration PoO approved for 83.7 acres of surface disturbance.	Active surface exploration project.
NVN-071238 and NDEP-BMRR Reclamation Permit No. 0243	1999	Barrick Rossi Mining Venture	Storm Underground Mine PoO. Underground mining and exploration. Approved for 194.6 acres of surface disturbance.	Active Underground Mine PoO.

[1] NEPA – National Environmental Policy Act.

Source: BLM 2011a.

2.2.3 Existing Facilities

2.2.3.1 Dee Gold Mine

The Dee Gold Mine operation is an existing open-pit gold mine with heap leach pads and tailings disposal facilities currently in final reclamation and closure. **Figure 2-1** shows the existing facilities including:

- Open pit;
- WRDF;
- Heap Leach Pad No. 1-9;
- Heap Leach Pad No. 10;
- Heap Leach Pad No. 11;
- Tailings Disposal Facility 1 (TD1), associated evapotranspiration (ET) cell and associated storm water diversion ditch;
- Tailings Disposal Facility 2 (TD2) and storm water diversion ditch;
- Ancillary facilities including: electrical supply system, clay borrow pits, water wells, water storage and supply system, three Class III waivered landfills, communications site, facility fencing, and haul and access roads; and
- Surface exploration areas including excavations, drill pads, sumps, trenches, and access roads (not specifically shown in **Figure 2-1**).

The existing facilities associated with past mining operations at the Dee Gold Mine disturbed 812 acres. Most of the existing facilities have been reclaimed and the bond has been released for earthwork and revegetation. Closure and reclamation monitoring is ongoing. Dee Gold Mine facilities that have not been reclaimed generally support the Storm Underground Mine and would be reclaimed when operations for that project cease.

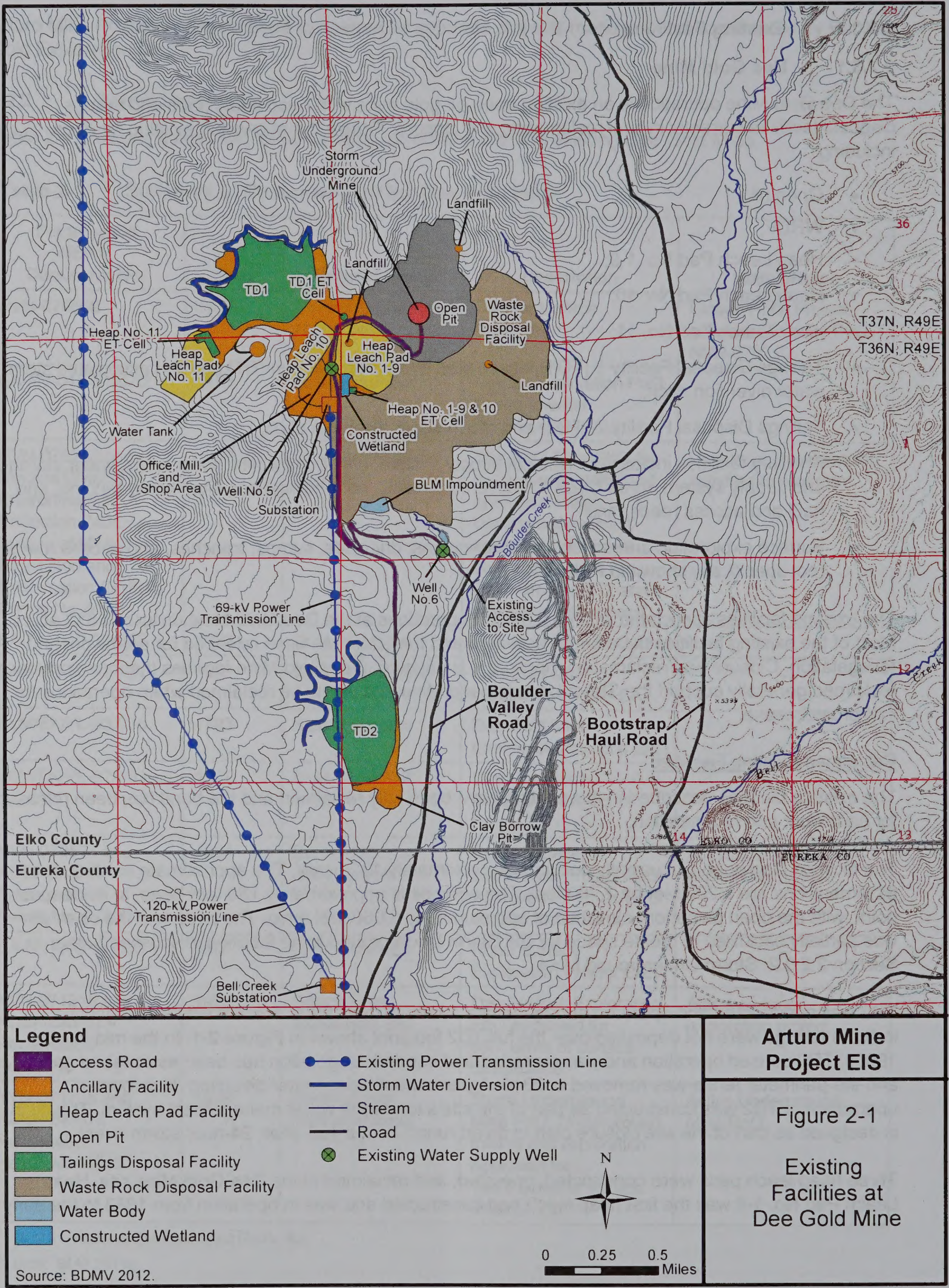
Reclaimed Existing Facilities

The existing facilities described in this section have been fully reclaimed and the bond has been released for earthwork and revegetation.

The existing Dee open pit currently occupies approximately 130 acres. The approximate existing open pit dimensions are 3,200 feet by 2,700 feet. The open pit is approximately 780 feet deep, at its deepest point, with the open pit bottom elevation of approximately 5,060 feet amsl. The bottom of the open pit was partially backfilled to create space for the Storm Underground Mine facilities, discussed further in Section 2.2.3.2, Storm Underground Mine.

TD2 was constructed and operated during the late 1980s to mid 1990s. Recent field investigations indicate tailings were not deposited over the full TD2 footprint shown in **Figure 2-1**. In the mid to late 1990s, TD2 ceased operation and was regraded and seeded. Vegetation has been established on TD2, and the perimeter fence was removed in 2010. A permanent storm water diversion ditch located upgradient of TD2 was constructed as part of the site's long-term water management system. The ditch is designed as part of the site closure plan to divert runoff from a 100-year, 24-hour storm event.

Three heap leach pads were constructed, operated, and reclaimed at the Dee Gold Mine site. Heap Leach Pad No. 1-9 was the first heap leach pad constructed and was in operation from 1983 to the early



Source: BDMV 2012.

Arturo Mine Project EIS

Figure 2-1

Existing Facilities at Dee Gold Mine

02/06/2012

1990s. This heap leach pad was regraded and seeded in the mid 1990s, and vegetation has been established. Heap Leach Pads No. 10 and No. 11 were constructed and operated during the mid to late 1990s. During closure and reclamation of these heap leach pads in the late 1990s, the processed ore material was regraded on the liners and covered with growth material. The heap leach pads were then seeded, and vegetation has been established. During reclamation, process ponds associated with the heap leach pads were converted to draindown management facilities. Draindown from Heap Leach Pad No. 1-9 and Heap Leach Pad No. 10 is combined and managed through a synthetically lined ET cell and clay lined constructed wetland facility located to the south of Heap Leach Pad No. 1-9. Draindown from Heap Leach Pad No. 11 is managed in a synthetically lined ET cell located on the northern perimeter of the facility. The draindown management facilities associated with the reclaimed heap leach pads at the site are monitored in accordance with state Water Pollution Control Permit No. NEV50005 that requires quarterly reporting to NDEP-BMRR.

The Dee Gold Mine office, mill, shop, warehouse, and lab facilities have been closed and the areas reclaimed. During demolition of the facilities, the associated materials (including hazardous and non-hazardous waste) were removed and disposed of in accordance with regulatory requirements. The area was regraded and seeded, and vegetation has been established.

Facilities Requiring Further Reclamation

TD1 has been reclaimed except for the segment adjacent to the water storage tank access road, and a portion of the bond for earthwork has been released. TD1 was the first tailings disposal facility constructed at the Dee Gold Mine, operating throughout the life of the mine. During the 1990s, a process pond with a synthetic liner was converted to an ET cell to collect seepage from the base of TD1. In the early 2000s, TD1 ceased operation and was regraded and seeded. Vegetation has been established on TD1. The ET cell was modified to manage seepage and storm water from the reclaimed facility as part of the closure plan, retaining the original synthetic liner. The segment of TD1 adjacent to the water storage tank access road currently remains unreclaimed to provide support for the Storm Underground Mine. This area would be reclaimed as part of the Storm Underground Mine closure plan. A permanent storm water diversion ditch located upgradient of TD1 was constructed as part of the site's long-term water management system. The ditch is designed as part of the site closure plan to divert runoff from a 100-year, 24-hour storm event.

The WRDF for the Dee Gold Mine has been reclaimed with the exception of areas undergoing exploration or supporting the Storm Underground Mine. The Dee Gold Mine WRDF ranges in height from 300 to 400 feet above the natural ground surface. The WRDF was constructed in lifts to facilitate an overall reclaimed slope ranging from approximately 2.5 horizontal units to 1 vertical unit (2.5H:1V) to 3H:1V. A limestone-lined french drain runs under the WRDF. Solution recovered in the french drain reports to an impoundment that was constructed by the BLM in 1964 in response to wildfires as discussed in Section 3.4, Water Resources and Geochemistry. The WRDF has been regraded and seeded, and vegetation has been established. The side-slope of the WRDF immediately adjacent to the access road would remain unreclaimed until the road is no longer needed by the Storm Underground Mine.

The former Dee Gold Mine electrical substation, power transmission line, and water supply system are currently supporting activities at the site and remain unreclaimed. Electrical power is currently provided to the proposed project area by NVEnergy, Inc. through a 69-kilovolt (kV) power transmission line right-of-way (ROW) NVN-038874. This power transmission line feeds a substation that supplies electrical power to the Storm Underground Mine via two separate power transmission lines.

Existing water wells No. 5 and No. 6 are located at the site as shown in **Figure 2-1**. Well No. 5 currently supplies water to the Storm Underground Mine. Well No. 6 is capped. Both wells ultimately would be properly plugged and abandoned at the close of the Storm Underground Mine.

Disturbance created for and associated with mineral exploration at the site is ongoing. Reclamation activities for exploration consist of backfilling sumps and trenches, regrading and recontouring drill sites and roads, and seeding to establish vegetation. Surface exploration activities conducted by Barrick Gold Exploration Inc. within the permitted Dee Gold Mine PoO NVN-070250 boundary include construction of drill sites, supporting sumps, roads, and trenches. To date, approximately 17 acres of exploration activities have been reclaimed within the Dee Gold Mine exploration PoO boundary. Exploration activities are also conducted on the north end of the Dee Gold Mine and adjacent area under the Barrick Meridian Joint Venture's Rossi surface exploration PoO NVN-070874. Exploration activities approved under the Rossi surface exploration PoO consisted of drilling 102 drill sites, construction of drill pads (approximate dimensions of 500 feet by 100 feet) and sumps (approximate dimensions of 16 feet by 50 feet), construction of up to 15 miles of road with an average roadbed width of 12 feet, and 10,000 feet of trenches with an average disturbance width of 25 feet. The Dee surface exploration PoO NVN-071216 consists of drilling 426 drill sites, construction of drill pads at approximate dimensions of 50 feet by 100 feet and sumps at 50 feet by 12 feet, construction of up to 15 miles of road with an average roadbed width of 12 feet, and trenches. Some of the surface disturbance associated with these exploration plans has been reclaimed while some remains unreclaimed. Vegetation is establishing on the reclaimed sites. Additional information on the mineral exploration permits at the site is provided in **Table 2-1**.

2.2.3.2 Storm Underground Mine

The existing Storm Underground Mine facilities are located within the proposed project boundary in areas that ultimately would be mined out by the proposed open pit or buried by the proposed West WRDF. The general location of the Storm Underground Mine and associated access road is shown in **Figure 2-1**.

The following Storm Underground Mine facilities are located in the bottom of the existing Dee open pit:

- WRDF for managing potentially acid generating (PAG) material;
- Ore stockpile areas;
- Office, parking, and support building facilities;
- Equipment yard;
- Compressors;
- Fuel tanks; and
- Concrete batch plant.

An additional WDRF for non-PAG waste rock and a laydown yard supporting the Storm Underground Mine are located outside of and northwest of the Dee open pit in the area that would be covered by the proposed West WRDF.

No dewatering facilities are associated with the Storm Underground Mine due to nearby Barrick Goldstrike Mines Inc. (BGMI) pumping that dewaters the area.

As discussed in Section 2.2.3.1, Dee Gold Mine, the Storm Underground Mine is supported by the following existing facilities that formerly were part of the Dee Gold Mine:

- The access road to the water tank adjacent to TD1;
- The western side slope of the Dee WRDF immediately adjacent to the access road entering the existing facility;
- Haul and access roads within the proposed project boundary;
- 69-kV power transmission line and associated substation;

- Two additional power transmission lines; and
- Water supply Well No. 5 and a water supply system for mining, dust control, process, and water for fire suppression.

Responsibility for closure and reclamation of these facilities has been transferred to the Storm Underground Mine. Reclamation of these facilities would occur upon closure of the Storm Underground Mine in accordance with the final closure plan.

As currently planned and permitted, the Storm Underground Mine would reach the end of its mine life before or during the proposed project operations. Depending on the mining schedule for the Storm Underground Mine and the approval schedule for the Proposed Action, the Storm Underground Mine could operate concurrently with the proposed project for a period of time. In this case, support facilities would continue to be shared, and activities for both projects would be coordinated by Barrick Gold Exploration Inc. Pending approval of the Proposed Action, the Storm Underground Mine PoO and reclamation permit would be amended to reflect the connection of the Storm Underground Mine and the Arturo Mine.

2.3 Proposed Action

The Proposed Action is a new project that is a combination of the expansion of the existing Dee Gold Mine open pit and construction of new processing, infrastructure, and ancillary facilities. The proposed project facilities are illustrated in **Figures 2-2** and **2-3**.

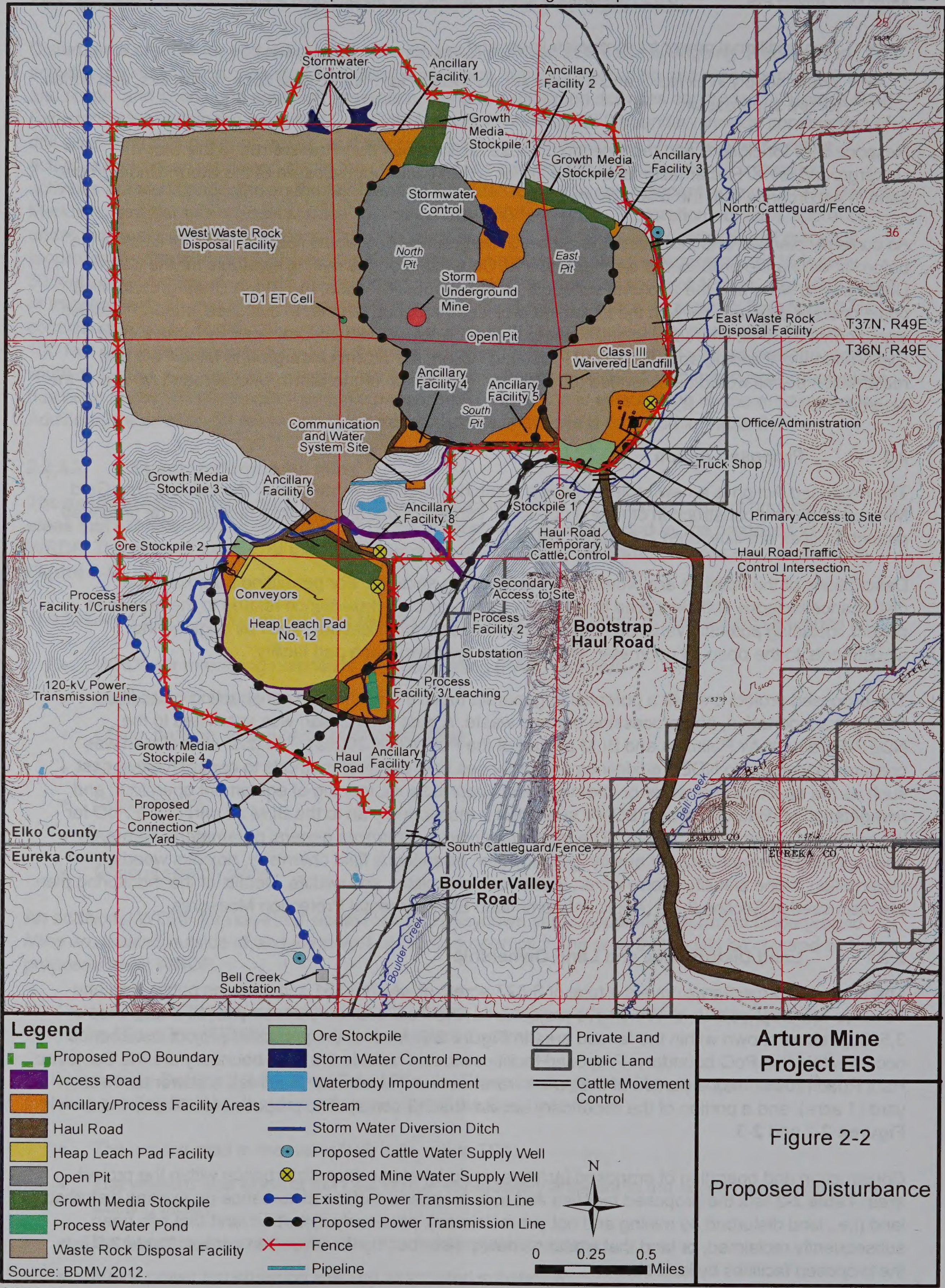
Descriptions of the facilities are provided in the following sections. For permitting purposes, the disturbance includes sufficient area to accommodate projected disturbance related to the proposed project, including potential variations resulting from design modifications, such as engineering adjustments to the open pit perimeter, WRDFs, and the heap leach pad facility.

The proposed project creates a potential to generate fugitive dust through construction of facilities, mining, transportation, and processing ore and waste. A dust control plan was submitted to the NDEP-Bureau of Air Pollution and BLM as part of the PoO (SRK 2009a). The dust control plan was prepared according to NDEP guidelines and proposes best practical methods to control fugitive dust such as the application of water or chemical dust suppressants, training of equipment operators, and revegetation of disturbed areas. BDMV submitted a monitoring plan to the BLM as part of the PoO for the proposed project (SRK 2009a). The monitoring plan summarizes general parameters, frequency, and reporting for monitoring air quality, groundwater, heap leach fluid chemistry, noxious weeds, reclamation, slope stability, storm water, waste rock chemistry, and wildlife. Details of the monitoring plan are discussed in Section 2.3.9, Applicant-committed Environmental Protection Measures.

2.3.1 Land Disturbance and Land Ownership

The proposed project area covers a total of 3,627 acres, of which 3,551 acres are on public land and 76 acres are on private land. Within this project area, the PoO boundary encompasses a total area of 3,513 acres as shown within the fenced area in **Figure 2-2**. Most of the proposed project disturbance occurs within this PoO boundary. Proposed facilities located outside the PoO boundary are the Bootstrap Haul Road (106 acres), a portion of the power transmission line corridor (5 acres), a power connection yard (1 acre), and a portion of the secondary access road (2 acres). The proposed facilities are shown in **Figures 2-2** and **2-3**.

Construction and operation of proposed facilities would create surface disturbance within the project area. **Table 2-2** lists the proposed facilities and their proposed surface disturbance on existing disturbed land (i.e., land disturbed by mining and not yet reclaimed), previously disturbed land that has been subsequently reclaimed, or land that would be newly disturbed by the proposed project. **Table 2-3** lists the proposed facilities by land status.



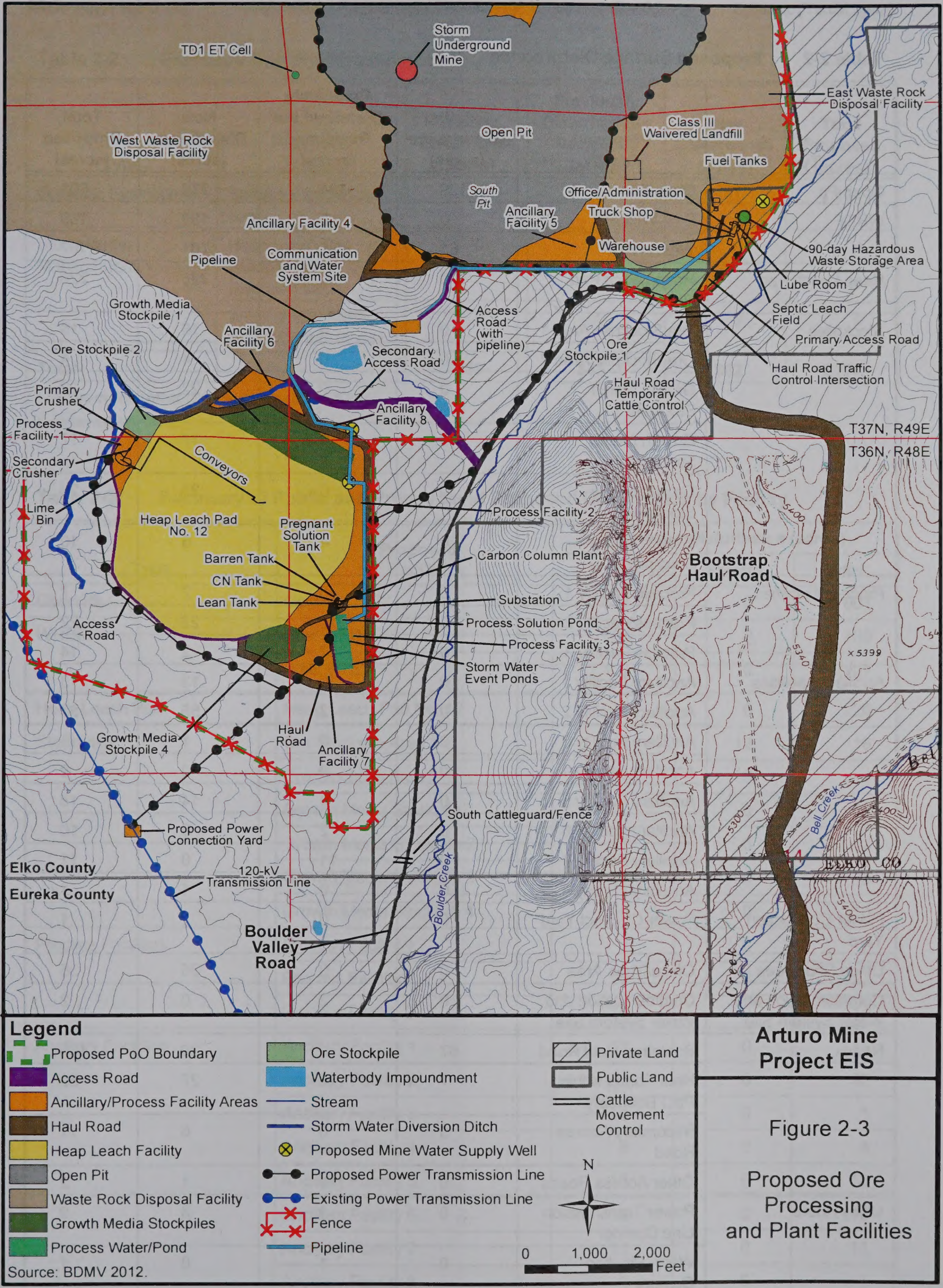
Source: BDMV 2012.

Arturo Mine Project EIS

Figure 2-2

Proposed Disturbance

8/6/2012



Source: BDMV 2012.

Arturo Mine Project EIS

Figure 2-3

Proposed Ore Processing and Plant Facilities

8/6/2012

Table 2-2 Proposed Surface Disturbance

Type	Proposed Facility	Existing Disturbance (acres)	Previously Disturbed but Reclaimed (acres)	New Disturbance (acres)	Total Proposed (acres)
Open Pit	Open Pit	129	194	278	601
WRDF	East WRDF	0	0	189	189
	West WRDF	61	285	761	1,107
Heap Leach Pad	Heap Leach Pad No. 12	0	0	226	226
Stockpiles	Ore Stockpile Area 1	0	0	16	16
	Ore Stockpile Area 2	0	0	4	4
	Growth Media Stockpile 1	0	0	22	22
	Growth Media Stockpile 2	0	0	17	17
	Growth Media Stockpile 3	0	0	23	23
	Growth Media Stockpile 4	0	4	6	10
Process Facilities	Process Facility 1	0	0	7	7
	Process Facility 2	0	0	22	22
	Process Facility 3	0	12	2	14
Ancillary Facilities	Ancillary Facility 1	0	0	13	13
	Ancillary Facility 2	0	2	55	57
	Ancillary Facility 3	0	0	1	1
	Ancillary Facility 4	0	8	0	8
	Ancillary Facility 5	0	4	14	18
	Ancillary Facility 6	0	2	8	10
	Ancillary Facility 7	0	11	0	11
	Ancillary Facility 8	0	0	1	1
Power Connection Yard	Power Connect Yard	0	0	1	1
Office Shop Area	Office/Shop Area	0	0	36	36
Communication and Water System Site	Communication and Water System Site	0	2	0	2
Roads	Bootstrap Haul Road	67	0	39	106
	Haul Roads within PoO Boundary	7	16	27	50
	Secondary Access Road	5	0	6	11
	Other Access Roads	0	1	1	2
Utility Route	Power Transmission Line Corridor	0	1	8	9
	Water Pipeline Corridor	0	1	0	1

Table 2-2 Proposed Surface Disturbance

Type	Proposed Facility	Existing Disturbance (acres)	Previously Disturbed but Reclaimed (acres)	New Disturbance (acres)	Total Proposed (acres)
Geologic Evaluations	Surface Exploration Areas[1]	0	0	161	161
Storm Water Management	Heap Leach Pad Storm Water Diversion Ditch	0	0	9	9
	West WRDF Storm Water Control Ponds	0	0	9	9
Total		**269**	**543**	**1,962**	**2,774**

[1] Acres overlap other disturbed acres listed in table.

Source: BDMV 2012.

Table 2-3 Summary of Public and Private Land Proposed Disturbance by Facility

Type	Proposed Facility	Proposed Disturbance (acres)		
		Public	Private	Total
Open Pit	Open Pit	601	0	601
WRDFs	East WRDF	189	0	189
	West WRDF	1,107	0	1,107
Heap Leach Pad	Heap Leach Pad No. 12	226	0	226
Stockpiles	Ore Stockpile Area 1	4	12	16
	Ore Stockpile Area 2	4	0	4
	Growth Media Stockpile 1	22	0	22
	Growth Media Stockpile 2	17	0	17
	Growth Media Stockpile 3	23	0	23
	Growth Media Stockpile 4	10	0	10
Process Facilities	Process Facility 1	7	0	7
	Process Facility 2	22	0	22
	Process Facility 3	14	0	14
Ancillary Facilities	Ancillary Facility 1	13	0	13
	Ancillary Facility 2	57	0	57
	Ancillary Facility 3	1	0	1
	Ancillary Facility 4	8	0	8
	Ancillary Facility 5	18	0	18
	Ancillary Facility 6	10	0	10
	Ancillary Facility 7	11	0	11
	Ancillary Facility 8	1	0	1

Table 2-3 Summary of Public and Private Land Proposed Disturbance by Facility

Type	Proposed Facility	Proposed Disturbance (acres)		
		Public	Private	Total
Power Connect Yard	Power Connection Yard	1	0	1
Office Shop Area	Office/Shop Area	15	21	36
Communication and Water System Site	Communication and Water System Site	2	0	2
Roads	Bootstrap Haul Road	73	33	106
	Haul Roads within PoO Boundary	50	0	50
	Secondary Access Roads	10	1	11
	Other Access Roads	2	0	2
Utility Route	Power Transmission Line Corridor	5	4	9
	Water Pipeline Corridor	1	0	1
Geologic Evaluations	Surface Exploration Area[1]	161	0	161
Storm Water Management	Heap Leach Pad Storm Water Diversion Ditch	9	0	9
	West WRDF Storm Water Control Ponds	9	0	9
Total		**2,703**	**71**	**2,774**

[1] Acres overlap other disturbed acres listed in table.

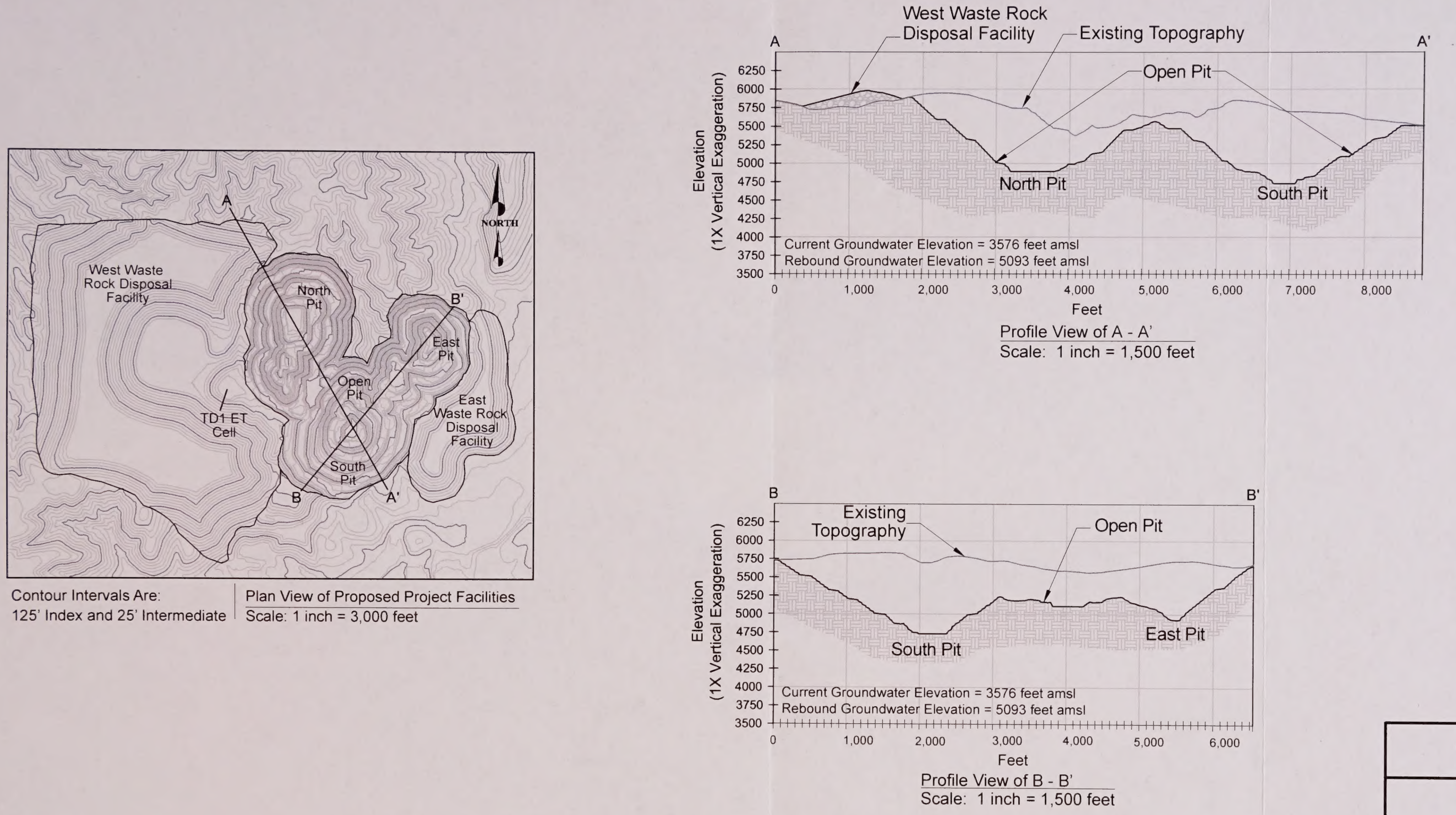
Source: BDMV 2012.

2.3.2 Open Pit

Proven and probable reserves of approximately 2.2 million ounces of gold and 10.6 million ounces of silver occur within the proposed project area. The proposed project would mine a total of approximately 64 million tons (MT) of ore from the open pit through the life of the mine (Schafer Limited LLC [Schafer] 2011a, August 29, 2011).

An estimated 570 MT of in-place waste rock would be mined from the proposed open pit, including minor amounts of waste rock from the Storm Underground Mine. Additionally, approximately 30 MT of previously mined waste rock from the reclaimed Dee Gold Mine WRDF would be excavated and moved to the West WRDF to allow for expansion of the proposed open pit. All waste rock would be managed according to BDMV's waste rock management plan as discussed in Section 2.3.3, Waste Rock Disposal Facilities. A summary of ore and waste rock quantities from the proposed open pit and their destination is provided in **Table 2-4**. A summary of the proposed schedule for mining ore and waste rock is provided in **Table 2-5**.

The removal of ore and waste rock from the proposed pit expansion areas would be accomplished using conventional open-pit mining methods including drilling, blasting, loading, and hauling. The average mining rate would be approximately 330,000 tons per day (tpd). **Figure 2-4** presents a cross-section of the proposed open pit area. The Proposed Action would deepen and enlarge the existing open pit.


A
B'
NORTH
West Waste Rock Disposal Facility
North Pit
East Pit
Open Pit
TD1 ET Cell
East Waste Rock Disposal Facility
South Pit
B
A'
West Waste Rock Disposal Facility
Existing Topography
Open Pit
A
A'
North Pit
South Pit
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
4250
4000
3750
3500
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Feet
B
B'
Existing Topography
Open Pit
South Pit
East Pit
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
4250
4000
3750
3500
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
Feet

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet

Profile View of A - A'
Scale: 1 inch = 1,500 feet

Profile View of B - B'
Scale: 1 inch = 1,500 feet

Arturo Mine Project EIS

Figure 2-4

Proposed Action Typical Cross-sections of Open Pit with Final Slopes

Source: BDMV 2011a.

05/24/12

Table 2-4 Open Pit Ore and Waste Rock Summary

Type of Material	Destination	Approximate Total Quantity[1]
Waste Rock – in-place	East, West WRDF, or used as cover/growth media	570 MT (includes minor amounts of Storm Underground Mine waste rock)
Waste Rock – previously mined from Dee Gold Mine	East or West WRDF	30 MT
Ore – leachable onsite	Heap Leach Pad No. 12	50 MT
Ore – mill grade, transported off-site	BGMI via Bootstrap Haul Road	14 MT

[1] Actual tonnage to be determined as mining proceeds, depending on economic and geologic conditions.

Source: BDMV 2011a.

Table 2-5 Proposed Action Mining Schedule[1]

Year	Total Waste Rock (MT)	Total Ore (MT)
1	68	6
2	100	1
3	85	7
4	87	12
5	60	2
6	66	10
7	73	19
8	61	7
Total	**600**	**64**

[1] Tonnages approximate and subject to change based on actual conditions during operations.

Source: Schafer 2011a.

Due to the shape of the ore body, the proposed open pit would consist of three lobes referred to as the North Pit, South Pit, and East Pit (**Figure 2-2**). The specific pit mining sequence would be determined by economic factors during operations. Pit design parameters (SRK 2012) for the three lobes include:

North Pit

- Pit bottom elevation – 4,890 feet amsl;
- Approximate dimensions – 3,600 by 2,800 feet; and
- Approximate depth – 1,010 feet.

East Pit

- Pit bottom elevation – 4,910 feet amsl;
- Approximate dimensions – 2,600 by 3,000 feet; and
- Approximate depth – 965 feet.

South Pit

- Pit bottom elevation – 4,730 feet amsl;
- Approximate dimensions – 2,800 feet by 3,700 feet; and
- Approximate depth – 1,020 feet.

The design of the proposed open pit is based on BDMV's experience at the Dee Gold Mine and similar geologic conditions at BGMI (Betze Pit), the results of geotechnical testing, and surface mining industry/Mine Safety and Health Administration (MSHA) standards. The preliminary design for the open pit has been evaluated for stability as described in Section 3.3, Geology and Minerals. BDMV would conduct additional geological and geotechnical studies and monitoring activities for the proposed open pit expansion during operations. Monitoring results would confirm pit wall stability. Pit slopes would be based on geological, geotechnical, and hydrological conditions as well as safety constraints. Ongoing geotechnical evaluations would refine the design parameters as mining progresses. The geologic and geotechnical characteristics of the materials exposed during mining would be monitored on a regular basis. Geologic structure mapping and slope stability analyses would be basic elements of an ongoing geotechnical program. Slope movement monitoring would be initiated to evaluate the safety of open-pit highwalls, as needed. In addition, operational procedures for controlling blasting and bench scaling would facilitate mining of stable open pit walls.

Based on preliminary designs, pit slopes would range from 26 to 58 degrees. Bench heights would range from approximately 20 to 60 feet. The pit expansion area would include a setback zone of up to 130 feet for haul roads, engineering design changes, minimal water handling activities, storm water controls, or other activities required during the normal operations.

It is anticipated that pit lakes would form in the three pit lobes following the completion of mining activities for the proposed project. Section 3.4, Water Resources and Geochemistry, provides detailed information regarding pit lake formation and water chemistry.

2.3.2.1 Open-pit Dewatering

The regional water table has historically intersected the area of the existing open pit at approximately 5,240 feet amsl. Dewatering operations at the BGMI site have lowered the water table to approximately 3,576 feet amsl, which occurs below the maximum depth (4,730 feet amsl) of the proposed pit. Therefore, no additional dewatering is required for the project. After the cessation of dewatering at the BGMI site, the water table at the proposed Arturo Mine is anticipated to rise to a steady-state level of approximately 5,093 feet amsl after 400 years, as discussed in Section 3.4, Water Resources and Geochemistry. Studies conducted by BDMV to evaluate groundwater recovery and the post-mining pit lakes within the proposed pit expansion area are discussed in Section 3.4, Water Resources and Geochemistry.

Past mining experience at BGMI and observation of the Carlin Formation at the existing Dee open pit indicate that localized, perched zones of water would be encountered in the Carlin Formation during mining operations. Although the proposed pit area is currently dewatered, localized zones in the Carlin Formation can drain slowly in response to dewatering. To enhance operating conditions and geotechnical stability, localized dewatering drains, sumps, and wells would be used to manage this water to promote and enhance drainage from dewatered zones. Storm water controls would be constructed as described in Section 2.3.6.9, Storm Water Management Facilities.

2.3.2.2 Drilling and Blasting

Drilling would be accomplished with the use of diesel-powered and/or electric blast-hole drill rigs. Blast holes would be loaded with an ammonium nitrate and fuel oil mixture or emulsion, which subsequently would be detonated. Unconsolidated gravels and growth media that do not require the use of drilling and blasting techniques prior to removal would be ripped with a dozer, as needed. Blasting would be performed under strict safety procedures as required by MSHA and the Bureau of Alcohol, Tobacco, and Firearms (BATF).

Explosives would be handled by licensed haulers and stored on site in compliance with the applicable Department of Homeland Security, BATF, and MSHA regulations. Federal, state, and county roads/highways would be used to transport explosives and other mining materials. Shippers would be licensed by the Department of Transportation and other appropriate agencies.

2.3.2.3 Loading

Hydraulic or electric shovels or hydraulic front-end loaders would be used to load rock into 190- to 340-ton haul trucks. Waste rock material would be trucked from the proposed pit area to adjacent WRDFs, as discussed further in Section 2.3.3, Waste Rock Disposal Facilities.

Mined ore would be transported over existing and proposed haul roads to ore stockpiles or process destinations, as described further in Section 2.3.5, Haul Roads and Site Access Roads.

2.3.3 Waste Rock Disposal Facilities

BDMV proposes to construct two WRDFs (West WRDF and East WRDF) (**Figure 2-2**) to accommodate the 600 MT of waste rock material from the pit expansion as shown in **Table 2-5**. A portion of the waste rock suitable for cover material and growth media would be stockpiled for future use or used during concurrent reclamation. The approximate schedule for mining waste rock is presented in **Table 2-5**. The specific sequence and schedule for mining waste rock and placing it in the WRDFs or utilizing it as cover/growth media would be determined during operations.

The existing three heap leach pads (No. 1-9, No. 10, and No. 11) that are located within the footprint of the proposed West WRDF would be excavated, and the material would be relocated to the proposed Heap Leach Pad No. 12 (Section 2.3.4.3, Heap Leach Pad Facility). The existing heap leach pad liners and drainage systems also would be excavated and placed within the proposed West WRDF.

The existing water supply well (Well No. 5) located within the footprint of the proposed West WRDF would be plugged and abandoned in accordance with applicable regulations prior to placement of waste rock in the West WRDF.

Material from the three existing Class III waivered landfills would be removed during mining and placed in the proposed Class III waivered landfill (Section 2.3.6.7, Chemical, Fuel, and Hazardous Material Storage). A certified environmental manager would be present during the excavation of the existing landfills. Any hazardous materials encountered would be properly managed and removed in accordance with applicable regulations. Landfill material would be placed in a manner where it would not be exposed to the surface after reclamation.

The existing TD1 facility located within the footprint of the West WRDF would remain in place. The West WRDF would be constructed to limit the depth of waste rock placed over TD1 to 50 feet in order to address geotechnical and water quality issues associated with deeper burial of TD1 as described in Section 2.4.1.1, Single WRDF Alternative Scenario – Deep Waste Rock Cover Placement Over TD1 Site. Under the Proposed Action, waste rock initially would be placed downgradient, or east, of the TD1 embankment providing a buttressing effect and enhancing the stability of TD1 prior to cover of the main facility. After placement of the buttressing material, the existing TD1 would be covered with up to 50 feet of waste rock that would create a low area relative to the highest point on the final configuration of the West WRDF. The overall slopes of the completed West WRDF would be consistent in shape to natural land forms in the surrounding area. Additionally, the West WRDF would be constructed around the existing TD1 ET Cell (Section 2.2.3, Existing Facilities). The TD1 ET Cell would continue to collect and manage seepage water from TD1 during the construction and after closure of the West WRDF. No waste rock would be placed on the TD1 ET Cell, which would retain its existing synthetic liner. **Figure 2-5** shows the ultimate shape of the West WRDF with a cross section showing the profile extending east from the full height of the dump, across the low area formed by the shallow cover over TD1, and ending at the TD1 ET Cell adjacent to the proposed open pit. Surface water on the West WRDF would be managed in accordance with the site Storm Water Pollution Prevention Plan (Section 2.3.6.9, Storm Water Management Facilities). Final slope angles of the WRDFs would be constructed to slow run-off velocity and reduce erosion potential. Surface water flowing to the east over the low area of the buried TD1 and the TD1 ET Cell would be diverted around the open pit by perimeter berms and/or ditches and managed in accordance with the Stormwater Pollution Prevention Plan (SWPPP) with other storm water from the West WRDF. **Table 2-6** provides the capacity and size of the proposed West WRDF.

Table 2-6 Proposed Action Waste Rock Disposal Facility Capacities and Heights[1]

Location	Capacity (MT)	Height (ags)[2]	Crest Elevation (feet amsl)	Footprint (acres)
West WRDF	550	615	6,090	1,107
East WRDF	50	210	5,650	189

[1] The amount of PAG material placed in each facility would be determined in accordance with the waste rock management plan.

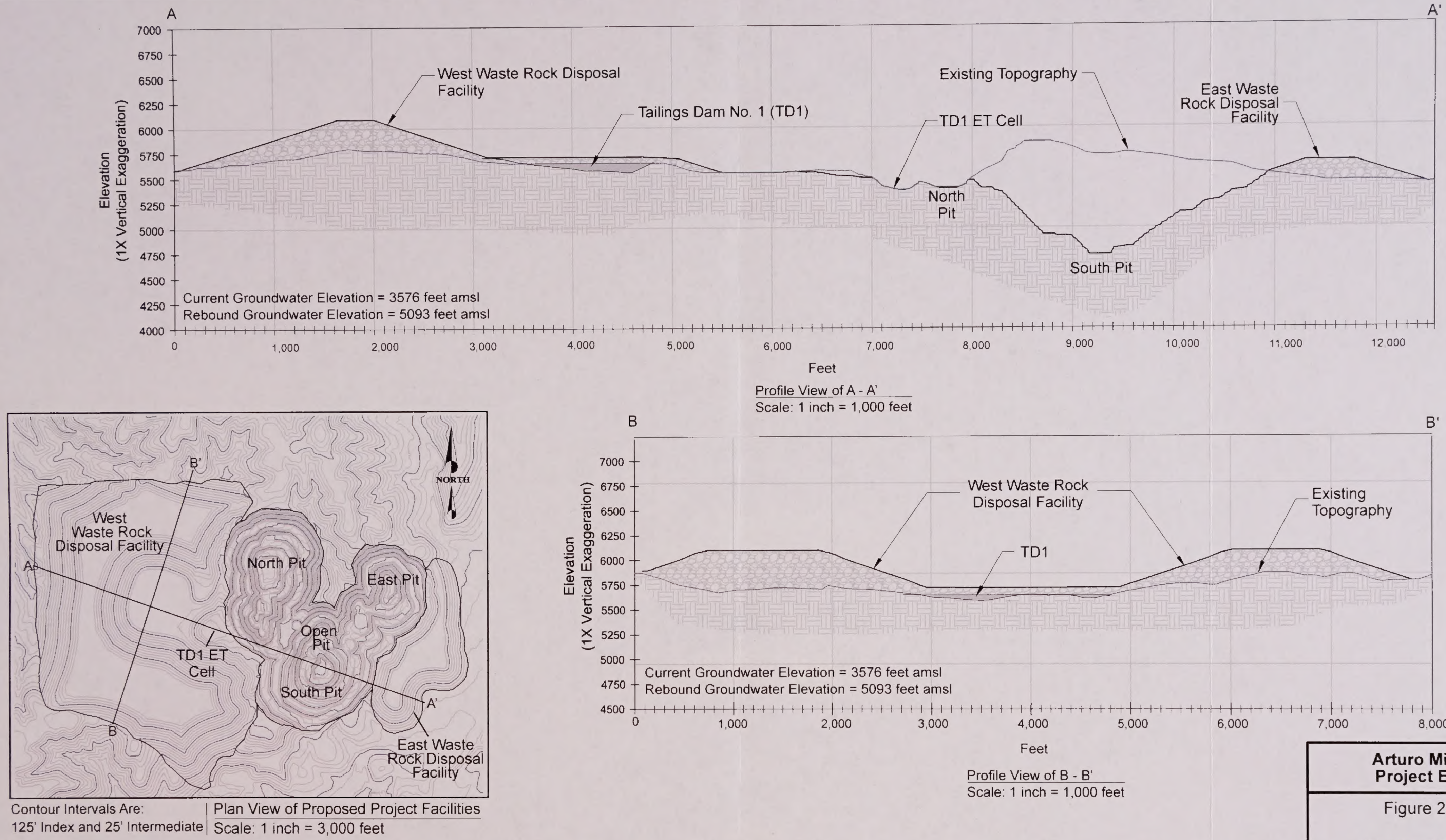
[2] ags = above ground surface

Source: BDMV 2011a.

The East WRDF primarily would be used for waste rock from the east and south pit lobes for shorter haulage distances. Additionally, the East WRDF would be used for waste rock placement in the initial stages of the mining schedule during the footprint preparation of the West WRDF (e.g., during the removal of the existing heap leach pads). **Table 2-6** provides information on size and capacity of the proposed East WRDF. **Figure 2-6** provides cross-sections of the East WRDF.

The footprint of the proposed WRDFs would include a buffer zone of up to 100 feet to provide for operational flexibility and to account for support facilities, such as storm water controls and haul roads. The proposed WRDFs have been designed to ensure long-term stability, to provide for effective reclamation, and to reduce overall visual impacts. Mined waste rock material would be hauled to the proposed WRDFs and placed by end-dumping from the top of the active faces, resulting in working faces at an angle of repose (approximately 1.3H:1V). The preliminary design of the WRDFs has been evaluated for stability (Section 3.3, Geology and Minerals). The WRDFs would be constructed in 50- to 150-foot lifts. The side slopes of the WRDFs would be graded to approximately 3H:1V for reclamation (Section 2.3.8.6, Reclamation of Proposed Project Facilities).

Baseline studies and laboratory testing have been completed in accordance with BLM guidance document Instruction Memorandum (IM) No. NV-2010-014 to determine waste rock material characteristics. The geochemical characterization of waste rock material has included 225 acid-base accounting tests, 89 Meteoric Water Mobility Procedure (MWMP) tests, and 6 humidity cell tests. Waste rock samples tested are representative of the rock type and oxidation state of the waste rock material to be mined.


A
A'
Elevation
(1X Vertical Exaggeration)
7000
6750
6500
6250
6000
5750
5500
5250
5000
4750
4500
4250
4000
West Waste Rock Disposal Facility
Tailings Dam No. 1 (TD1)
Existing Topography
TD1 ET Cell
East Waste Rock Disposal Facility
North Pit
South Pit
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Feet
B'
NORTH
West Waste Rock Disposal Facility
North Pit
East Pit
Open Pit
A
TD1 ET Cell
South Pit
B
A'
East Waste Rock Disposal Facility
B
B'
Elevation
(1X Vertical Exaggeration)
7000
6750
6500
6250
6000
5750
5500
5250
5000
4750
4500
West Waste Rock Disposal Facility
Existing Topography
TD1
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Feet

Profile View of A - A'
Scale: 1 inch = 1,000 feet

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet

Profile View of B - B'
Scale: 1 inch = 1,000 feet

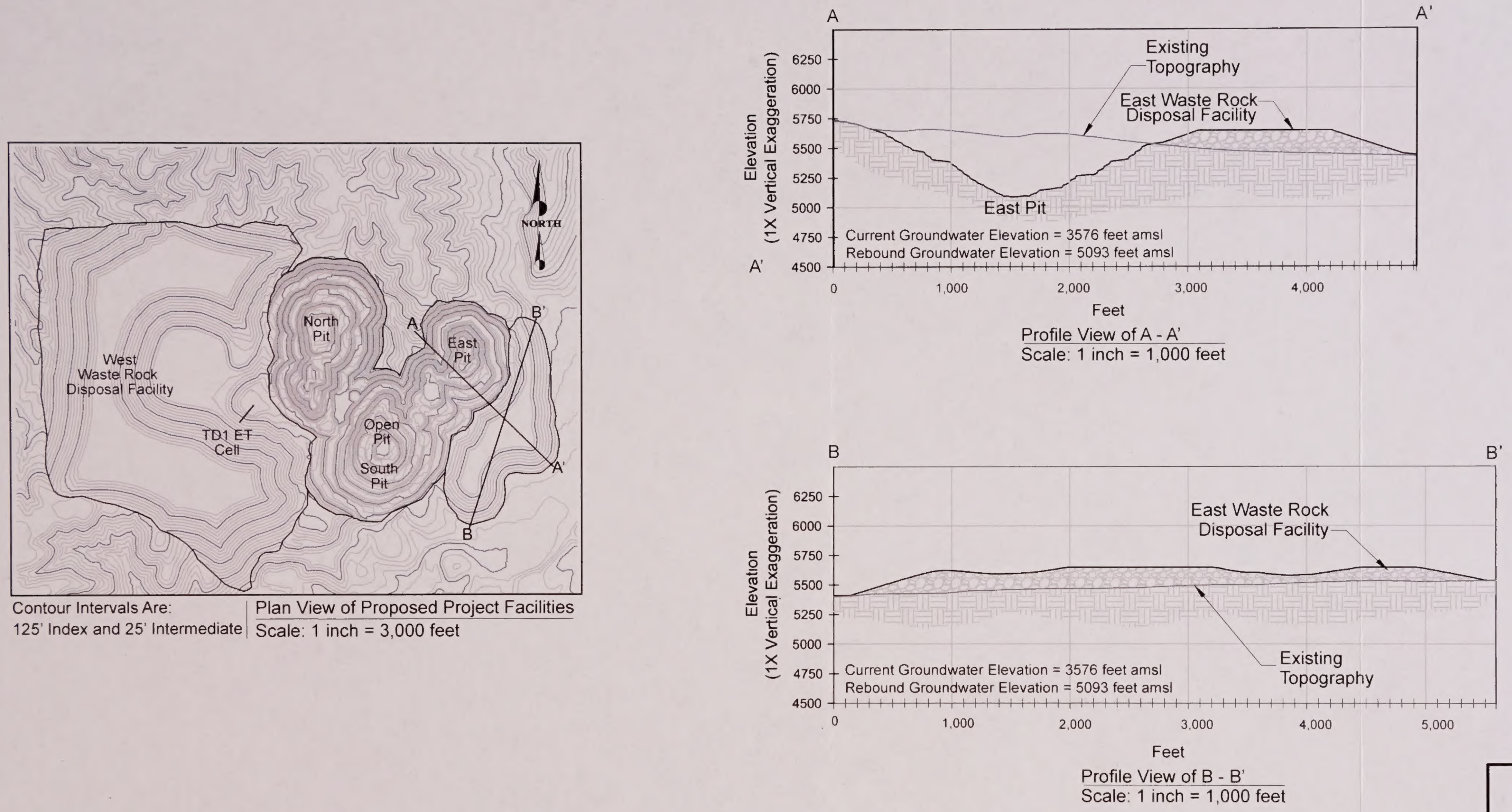
Arturo Mine Project EIS

Figure 2-5

Proposed Action
Typical Cross-sections
of the West WRDF
and Open Pit
with Reclaimed Slopes

Source: BDMV 2012.

06/11/12


NORTH
West Waste Rock Disposal Facility
TD1 ET Cell
North Pit
Open Pit
South Pit
East Pit
A
A'
B
B'
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
0
1,000
2,000
3,000
4,000
5,000
Feet
Existing Topography
East Waste Rock Disposal Facility
East Pit
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet

Profile View of A - A'
Scale: 1 inch = 1,000 feet

Profile View of B - B'
Scale: 1 inch = 1,000 feet

Arturo Mine Project EIS

Figure 2-6

Proposed Action Typical Cross-sections of the East WRDF and Open Pit with Reclaimed Slopes

Source: BDMV 2012.

05/24/12

BDMV's waste rock management plan prepared by Schafer was submitted to the BLM as part of the PoO (SRK 2009a). The waste rock management plan provides a summary of the geochemical characterization testing and proposes a selective waste handling methodology to minimize the risk of impact to the environment from PAG waste rock that has the potential to release metals or acidity or both during weathering. Testing and management of waste rock according to the waste rock management plan is discussed in Section 3.4, Water Resources and Geochemistry.

2.3.4 Ore Processing

The proposed ore processing would include both on-site heap leaching and off-site mill processing. As determined by economic considerations, some ore from the proposed pit would be stockpiled at the site for sale and transportation by truck on the Bootstrap Haul Road to the BGMI site for processing, as discussed in Section 2.3.4.6, Barrick Gold Mines Inc. Ore Processing. A schematic of the ore processing circuit is illustrated in **Figure 2-7**. The location of the proposed on-site ore processing facilities are provided in **Figure 2-3**. Ore processing facilities are described in more detail in the following sections.

Monitoring of the groundwater system within the area of the heap leach pad and processing facilities would be conducted using monitoring wells located downgradient and upgradient of the heap leach pad and processing facilities in compliance with the Water Pollution Control Permit.

2.3.4.1 Ore Stockpiles

Ore would be delivered to two stockpile areas for further handling. Information on the size of the stockpile areas is presented in **Table 2-2**, and the locations are shown in **Figures 2-2** and **2-3**. Ore Stockpile Area 1 would be located near the primary access road. Ore Stockpile Area 1 would receive and store mill-grade ore for shipment on the Bootstrap Haul Road to BGMI for further processing. Ore Stockpile Area 2 would be located near Heap Leach Pad No. 12, providing a staging area for on-site leach ore, as needed.

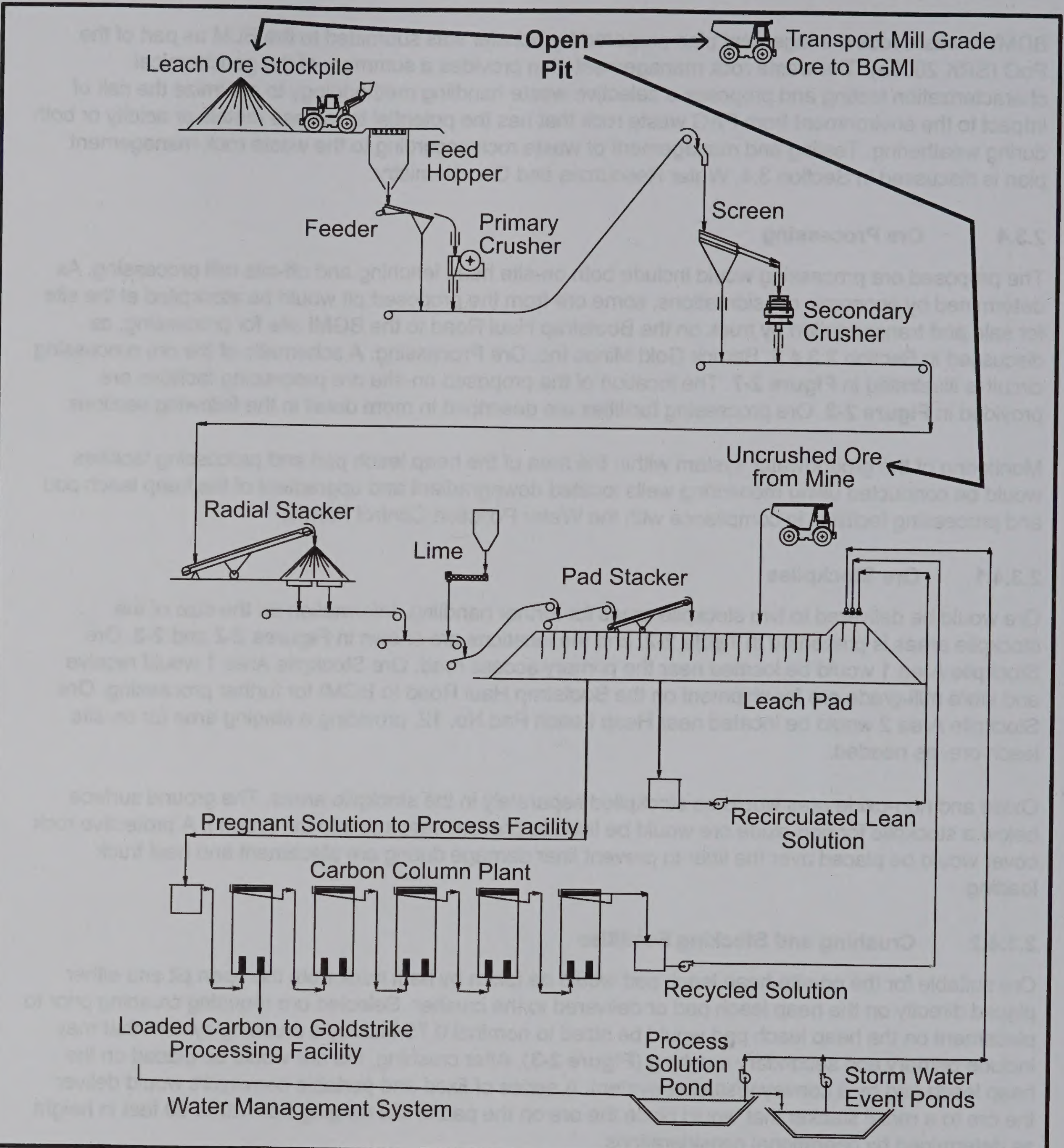
Oxide and non-oxide ores would be stockpiled separately in the stockpile areas. The ground surface below a stockpile for non-oxide ore would be lined to prevent seepage into the ground. A protective rock cover would be placed over the liner to prevent liner damage during ore placement and haul truck loading.

2.3.4.2 Crushing and Stacking Facilities

Ore suitable for the on-site heap leach pad would be taken by haul truck from the open pit and either placed directly on the heap leach pad or delivered to the crusher. Selected ore requiring crushing prior to placement on the heap leach pad would be sized to nominal 0.75-inch by a crushing system that may include primary and secondary crushing (**Figure 2-3**). After crushing, the ore would be placed on the heap leach pad by a conveyor/stacker system. A series of fixed and portable conveyors would deliver the ore to a radial stacker that would place the ore on the pad in lifts ranging from 20 to 50 feet in height as determined by operational considerations.

2.3.4.3 Heap Leach Pad Facility

Approximately 50 MT of leach-grade ore from the open pit would be processed on the proposed Heap Leach Pad No. 12. Heap Leach No. 12 also would receive 9.5 MT of material from the three existing heap leach pads (Heap Leach Pads No. 1-9, No. 10, and No. 11) that are located within the footprint of the West WRDF as described in Section 2.3.3, Waste Rock Disposal Facilities. The amount of material contained in the existing heaps is provided in **Table 2-7**. The existing heap leach pad facilities would be excavated using conventional surface mining methods. A loader or shovel would load the heap leach pad material into trucks for transport and stacking on the new proposed Heap Leach No. 12. The heap leach pad liners and associated draindown management facilities (described in Section 2.2.3, Existing Facilities) would be excavated and placed within the West WRDF. Excavation of the existing heap leach



Arturo Mine Project EIS

Figure 2-7

Simplified Schematic of the Ore Processing Circuit

Source: BDMV 2010a.

05/15/12

Table 2-7 Existing Heap Leach Pad of Material to be Excavated

Heap Leach Pad	Quantity (MT)
No. 1-9	4.4
No. 10	2.5
No. 11	2.6
Total	**9.5**

Source: BDMV 2011a.

pad facilities would begin during the first year of operation and would advance at a rate sufficient to provide space for waste rock storage in the proposed West WRDF. Heap Leach Pad No. 12 is designed to have a capacity of 80 MT, allowing for additional capacity if required based on operational needs.

The footprint of the proposed heap leach pad would create new disturbance adjacent to, but not covering, the existing TD2 and would include a buffer zone of up to 100 feet to allow for engineering design changes, access roads, or support activities necessary as part of normal operations. The proposed heap leach pad would cover a portion of the existing storm water diversion ditch located upgradient of TD2. Operation of the heap leach pad would occur in accordance with water pollution control permit criteria and the BLM Cyanide Management Plan.

The proposed Heap Leach Pad No. 12 location is designed to take advantage of the existing topographic slope which has the natural gradient required for gravity flow of process fluids to the process facilities while minimizing the cut and fill required to prepare the footprint. Other aspects of the proposed placement of Heap Leach Pad No. 12 are to minimize the haul distance from the open pit and decrease visibility from the Boulder Valley road, as existing topographic contours allow.

The heap leach pad facility would be constructed and operated consistent with Nevada Administrative Code (NAC) 445A.432 and 445A.434 and would meet International Cyanide Code requirements. The heap leach pad facility would consist of the following primary facilities:

- Geomembrane/composite-lined heap leach pad;
- Geomembrane/composite-lined process and storm water event ponds;
- Solution application system;
- Solution collection system placed above the liner system;
- Solution containment ponds;
- Leak detection/collection systems; and
- Secondary containment for process pipelines.

Leach-grade ore would be placed on the heap leach pad in lifts of up to 50 feet. The pre-feasibility design of the heap leach pad was evaluated as described in Section 3.3, Geology and Minerals. The estimated maximum heap height would be 370 feet above ground level. To reduce closure earthwork costs and maintain the reclaimed heap within the perimeter berm, the heap would be designed at an overall angle of approximately 3H:1V. A typical heap cross-section is illustrated in **Figure 2-8**.

The heap leach pad facility would be designed as a closed circuit, zero discharge facility with the capacity to contain all process fluids and meteoric waters generated by a 100-year, 24-hour storm event. In addition, the facility would be designed to provide for containment of a 24-hour draindown resulting from power losses or unscheduled shutdown. The facility would be surrounded by containment berms to prevent surface water run-on from entering the facility and to provide for containment of process solutions. Storm water diversion channels designed to contain flow from a 100-year, 24-hour storm event would be constructed around the facility, where needed.

An 80-mil high density polyethylene (HDPE) geosynthetic liner would be used for the primary liner and would overlay a 12-inch-thick soil subliner compacted to provide an in-place permeability of 10^{-6} centimeters per second. Below the soil subliner, a leak collection and recovery system would be built under areas where head may accumulate on the primary liner. A drainage layer consisting of a network of perforated drainage pipe covered by at least 36 inches of crushed rock would be placed on top of the primary liner to: 1) reduce the potential for small punctures to the primary liner; and 2) provide for collection of pregnant (gold-bearing) solution; and 3) reduce the hydraulic head on the liner. Pregnant solution would percolate through the ore to the synthetic liner and into solution collection pipes to the process facility and solution containment ponds.

Crushed leach-grade ore would be placed in lifts on the pad by a conveyor/stacker, as described in Section 2.3.4.2, Crushing and Stacking Facilities. Uncrushed ore would be placed on the pad by mine haul trucks (direct haul ore). Crushed ore would be placed at a rate of approximately 200,000 tons per month, and uncrushed ore placement would be determined by operational considerations.

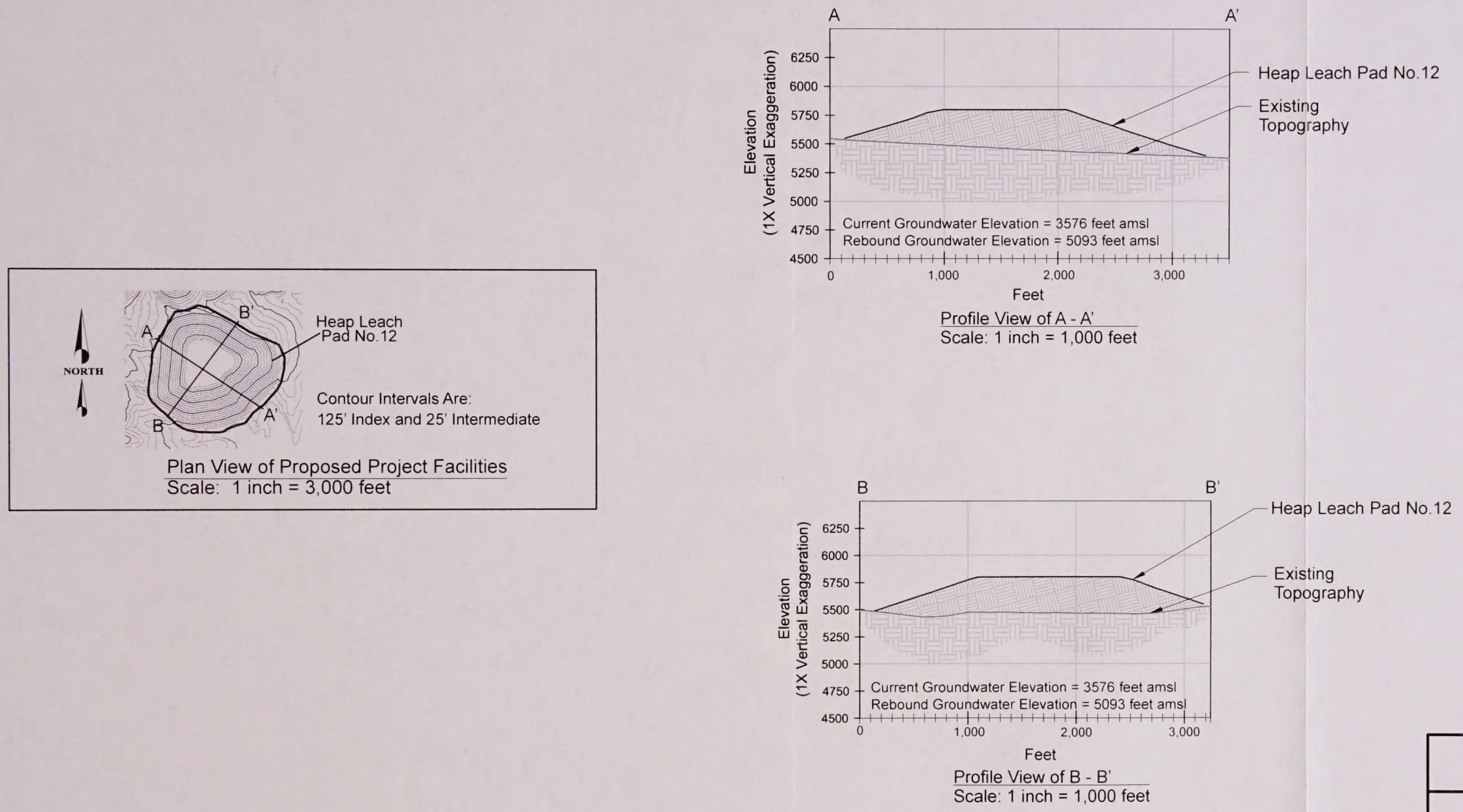
Lime or caustic (when necessary for pH control during leaching) would be added to the direct haul ore and conveyor-stacked ore prior to placement on the pad. Lime would be supplied to direct haul trucks from a lime bin located on the main haul road between the open pit and Heap Leach Pad No. 12. An additional lime bin located near the secondary crusher would supply lime to crushed ore prior to placement on the heap leach pad. Information on lime usage is provided in Section 2.3.6.7, Chemical, Fuel, and Hazardous Material Storage.

Once a lift is completed, a network of drip lines would be placed on top of the ore pile, and a dilute solution of sodium cyanide would be applied to the ore. Scarifying and regrading areas on the heap leach pad would be done, as needed, to prevent ponding or pooling of process solution. After percolating through the heap, the leach solution would be collected in pipes under the heap leach pad and routed to the pregnant or lean solution tank.

2.3.4.4 Process Plant Facility

The on-site process plant would receive solution from the heap leach pad for metal recovery. The process plant and associated process pond facilities would be located on or near the upgradient edge of the existing reclaimed TD2 that ceased operation in 1992. A test pit on TD2 indicates the depth of tailings in the area of the proposed process plant is less than 5 feet, and the plant facility could be built without compromising the integrity of TD2. Construction of the process facilities would be completed to an established factor of safety under static and local seismic pseudostatic conditions. These factors of safety determinations would be made according to state and federal regulations via data collected from field investigations during construction and subsequently verified by facility inspection. The TD2 structural embankment would not be disturbed or compromised by the proposed project activities.

The process plant facility is comprised of a number of tanks (cyanide, barren, and pregnant solution tanks) and the carbon column plant. The location of the facilities is provided in **Figure 2-3**, and a schematic of the processing circuit is provided in **Figure 2-7**. Routing process solutions to the pregnant or barren tanks would be determined by the process operator. Pregnant solution has a higher concentration of gold in solution ready for recovery. Lean solution has a concentration of gold too low for recovery, and may be recirculated onto the heap leach pad to increase concentrations through leaching. The process operator opens or closes a valve at the front of the pad to control the flow direction and direct the solution to the appropriate tanks. To facilitate the extraction of gold, the pregnant solution would be pumped through a series of carbon columns where metals would be adsorbed by the activated carbon granules. The estimated solution handling rate for the carbon column circuit is 4,000 gallons per minute (gpm). Barren solution from the carbon column circuit would be recycled back to the proposed


NORTH
A
B'
B
A'
Heap Leach Pad No.12
Contour Intervals Are:
125' Index and 25' Intermediate
Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet
A
A'
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
0
1,000
2,000
3,000
Feet
Heap Leach Pad No.12
Existing Topography
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
Profile View of A - A'
Scale: 1 inch = 1,000 feet
B
B'
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
0
1,000
2,000
3,000
Feet
Heap Leach Pad No.12
Existing Topography
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
Profile View of B - B'
Scale: 1 inch = 1,000 feet

Arturo Mine Project EIS

Figure 2-8

Typical Heap Leach Pad Cross-sections with Reclaimed Slopes

Source: BDMV 2010a.

05/24/12

heap leach pad for re-use. Loaded (gold-bearing) carbon would be removed from the circuit, placed in a sealed vessel, and sold to BGMI for further processing.

Leach solution handling tanks, equipment, piping, and reagent storage would be located on a lined containment that drains to the solution collection system.

2.3.4.5 Process Solution Collection System

BDMV proposes to construct one process solution pond and two storm water event ponds immediately southeast of the proposed Process Plant facility, as shown in **Figure 2-3**.

The process solution pond would be double-lined with HDPE material and would have continuous leak collection and recovery system between the liners. The process solution pond would be sized to contain run-off and draindown from a 24-hour power loss and a 100-year, 24-hour storm event. The process solution pond would be fenced with an 8-foot-high wildlife exclusion fence and covered with “bird balls” or wildlife netting to prevent volant (flying animals) and terrestrial wildlife access per the industrial artificial pond permit.

Two storm water event ponds would be designed to contain runoff from the heap leach pad facility resulting from a 100-year, 24-hour storm event while maintaining 2 feet of freeboard. The storm water event ponds would be single lined with HDPE. Under normal operating conditions, the storm water event ponds would not contain process solution. Storm water present in the storm water event ponds would be managed passively, with no pumps required under normal conditions. Depending on operating conditions, the storm water event ponds may be fenced in a manner allowing means for wildlife to exit the area if inadvertently entering the ponds.

If emergency or upset conditions arise, solution from the process plant facility would report to the process solution pond, which could then overflow to one of the two storm water event ponds. Solution reporting to the process solution pond would be pumped back into the system for reuse in the leaching process. If process solution overflows to the storm water event ponds, pumps would be installed and the solution would be pumped back to the system for re use.

Approximate pond volume and additional information on the solution collection system is presented in **Table 2-8**. Additional information on the location of the ponds in relation to the existing reclaimed TD2 is provided in Section 3.3, Geology and Minerals.

Table 2-8 Solution Collection System Pond Sizing

Facility	Normal Operating Capacity (million gallons)	Total Capacity (million gallons)	Approximate Dimensions (feet)
Process Solution Pond	2.8	4.0	200 x 200
Storm Water Event Pond No. 1	0.0	7.0	300 x 300
Storm Water Event Pond No. 2	0.0	7.0	300 x 300

Source: BDMV 2010a.

2.3.4.6 Barrick Goldstrike Mines Inc. Ore Processing

Based on metallurgical and economic considerations, an average of 1.8 MT per year (4.5 MT per year maximum) mill-grade ore from the proposed open pit would be sold to BGMI for further processing.

Transportation of the mill-grade ore would be on the Bootstrap Haul Road (Section 2.3.5.2, Bootstrap Haul Road). Ore from the proposed project would be processed under existing BGMI permits and no expansion of BGMI facilities would be necessary.

The BGMI's existing processing facilities consist of an autoclave circuit, which is used to treat non-carbonaceous sulfide (refractory) ore; and a roaster used for treating carbonaceous ore (not suitable for autoclaving). These facilities currently treat ores from the existing BGMI surface and underground operations, as well as other mines in the region.

The autoclave circuit consists of wet grinding and milling, autoclave, and carbon-in-leach (CIL) processes. The autoclave circuit is capable of handling 20,000 tpd. Ore is milled to the appropriate size and then delivered to one of six pressure oxidation vessels (autoclaves) in which heat, pressure, and oxygen are added to the ore slurry to oxidize the sulfide minerals. Following pressure oxidation, the ore slurry is delivered to the CIL vessels where a dilute cyanide solution is used to dissolve the gold in the ore. The gold is then adsorbed onto activated carbon particles that are screened from the slurry and sent to the stripping circuit for gold recovery. The remaining slurry, now referred to as tailings, is treated to neutralize residual cyanide, and the slurry is pumped to one of BGMI's tailings disposal facilities.

The roaster circuit consists of dry grinding and milling, roaster oxidation, and CIL processes. The roaster facility has a capacity of 18,500 tpd. Ore is dry milled to the appropriate size and then put through the ore oxidation (roasting) process followed by a CIL gold recovery process similar to that described above for the autoclave circuit.

The mill/CIL process connected to the roaster CIL can be run separately for ores that do not require roaster or autoclave processing prior to CIL recovery (oxide ore). Of the ore shipped to BGMI for processing, approximately 18 percent would be processed by autoclave, 10 percent by roaster, and 72 percent would go directly to the mill/CIL process (BDMV 2011a).

2.3.5 Haul Roads and Site Access Roads

This section describes the on-site haul roads, the off-site Bootstrap Haul Road, and light vehicle access to the proposed site.

Provisions to facilitate movement of cattle along the roadways is discussed in Section 2.3.9.10, Cattle Movement and Access to Water. Storm water control best management practices (BMPs) would be established along roadways according to the SWPPP (Section 2.3.6.9, Storm Water Management Facilities).

2.3.5.1 On-site Haul Roads

The location of the main haul roads within the project boundary is provided in **Figures 2-2** and **2-3**. Haul roads would be built to 140-foot width including berms and ditches, with an active roadbed width of 113 feet to allow two-way haul truck haulage.

Roads would be sprayed with water or approved dust suppression chemicals such as magnesium chloride, calcium chloride, or lignin sulfonate on an as needed basis.

2.3.5.2 Bootstrap Haul Road

The existing Bootstrap Haul Road is proposed as the primary transportation route to and from the proposed project for employees, contractors, suppliers and other authorized traffic. Additionally, the Bootstrap Haul Road would be used by large haul trucks (190- to 340-ton) to transport mill-grade ore approximately 3.5 miles south from the proposed project to the processing facilities at BGMI.

The Bootstrap Haul Road would be widened from the traffic control intersection at the Boulder Valley Road on the north end of the road to the western boundary of private land controlled by BGMI on the southern end, as shown in **Figures 1-2** and **2-2**. The widened road would accommodate both light vehicles and large off-highway mine haul truck traffic in lanes separated by an earthen berm, as shown in **Figure 2-9**. The proposed project would expand the existing Bootstrap Haul Road to a total width of 250 feet, including safety berms and drainage ditches. Signs, berm height, grade, drainage and other features required for traffic safety for both the haul trucks and light vehicles along the road would be installed as part of the road improvements.

The roadbed width for the haul truck lane would be 120 feet to allow two-way traffic. Truck traffic would be present for up to 24 hours per day, 365 days per year. Up to 78 one-way trips per day would occur on the Bootstrap Haul Road, hauling a maximum of 4.5 MT per year of mill-grade ore to BGMI processing facilities.

The light vehicle lane on the Bootstrap Haul Road would have a roadbed width of 60 feet allowing two-way traffic for most vehicles. Oversized vehicle use of the light vehicle lane would be controlled using standard traffic safety road procedures when necessary.

Access to the Bootstrap Haul Road would be controlled from the north by gates at the haul truck traffic control intersection (**Figures 2-2** and **2-3**) (Section 2.3.5.3, Primary Site Access and Haul Road Traffic Control Intersection). The existing BGMI security station would control unauthorized entrance to the Bootstrap Haul Road from the south.

The Bootstrap Haul Road currently crosses Boulder Creek and Bell Creek. The creeks pass beneath the roadway through a series of culverts that would be extended to accommodate the additional width required for the haul truck and light vehicle lanes. Storm water BMPs would be implemented along the Bootstrap Haul Road in accordance with the proposed SWPPP (Section 2.3.6.9, Storm Water Management Facilities).

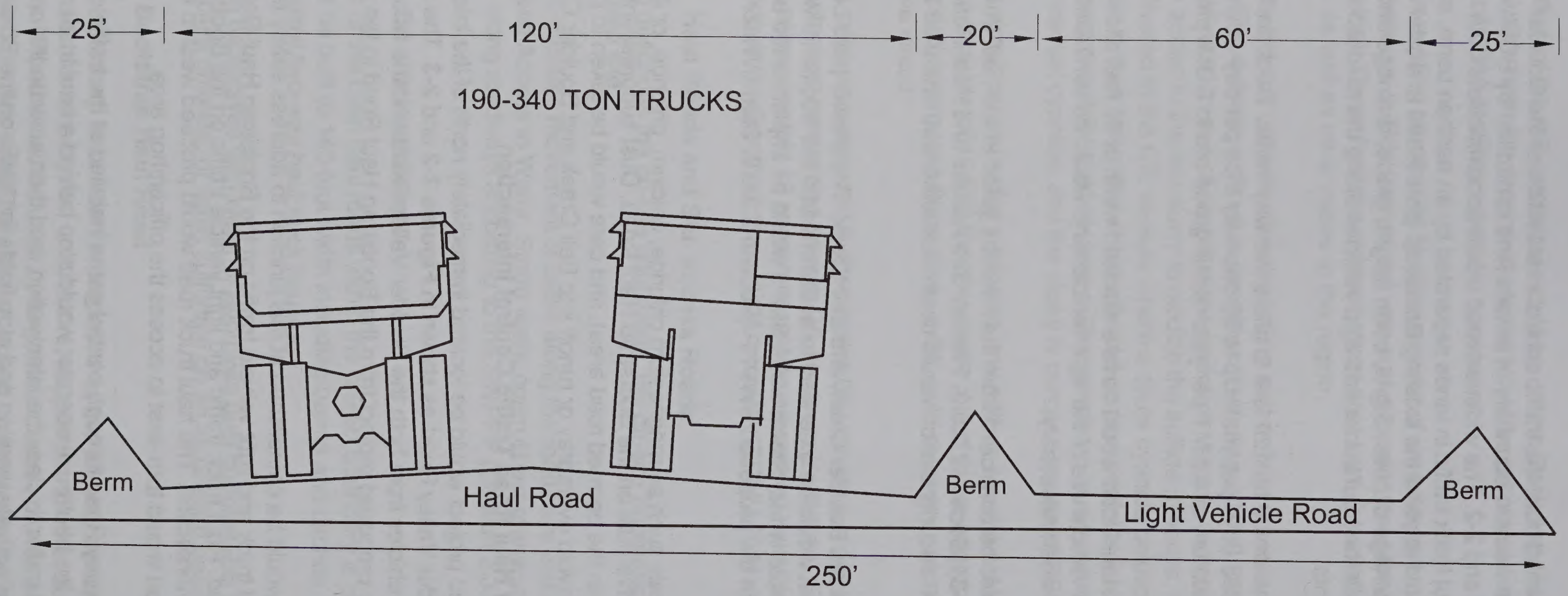
Water or approved dust control chemicals such as magnesium chloride, calcium, chloride, or lignin sulfate would be used to minimize fugitive dust on the Bootstrap Haul Road. Dust suppressants would be applied to the driving surface only (within the bermed road area), and care would be taken to prevent excessive application rates in order to avoid overspray or runoff into Bell Creek and Boulder Creek.

2.3.5.3 Primary Site Access and Haul Road Traffic Control Intersection

The primary site access to the proposed project would be located immediately north of the intersection of the Bootstrap Haul Road and the Boulder Valley Road as shown in **Figures 2-2** and **2-3**. The primary entrance would be accessible to light vehicles from both the Boulder Valley Road and the Bootstrap Haul Road. Haul trucks also would enter the proposed project from the Bootstrap Haul Road in the same vicinity as light vehicles.

A haul road traffic control intersection would be established at this junction to address safety issues arising from the interface between haul truck and light vehicle traffic on the Bootstrap Haul Road and traffic on the public Boulder Valley Road. Haul truck traffic and light vehicle traffic on the Bootstrap Haul Road would split at the traffic control/intersection. The haul truck road would proceed west to the stockpile area, and the light vehicle road would turn east to access the office/shop area.

Haul trucks would cross the Boulder Valley Road through control gates installed at the traffic control intersection. To cross the intersection, the haul truck operator would stop behind a haul truck control gate, wait for any Boulder Valley Road traffic to clear the intersection, and then activate the crossing alarm system. The alarm system would activate warning and stop lights for traffic on the Boulder Valley Road. After a suitable pause to ensure any traffic on the Boulder Valley Road has stopped, the traffic control gate on the Bootstrap Haul Road would raise, allowing the haul truck to proceed across the



Arturo Mine Project EIS

Figure 2-9

Typical Bootstrap Haul Road Cross-section

Source: BDMV 2010a.

05/15/12

intersection. After the haul truck has passed through the intersection, the haul truck control gate would again be lowered, the crossing alarms would cease, and traffic on the Boulder Valley Road would proceed.

After clearing the haul road traffic control intersection, haul trucks would be confined to the appropriate lane of the Bootstrap Haul Road and directed to the Ore Stockpile Area 1 area and subsequently onto the site haul roads, as depicted in **Figure 2-3**.

Light vehicle traffic authorized to travel on the Bootstrap Haul Road would cross the Boulder Valley Road through the traffic control intersection using only the dedicated light vehicle lane. Stop signs at the intersection would give traffic on the Boulder Valley Road the ROW over light vehicle traffic on the Bootstrap Haul Road. Upon entering the site, light vehicles would check in at a security entrance for authorization. The security entrance would include a vehicle gate and weigh scales.

Light vehicles also would be able to access the primary entrance to the proposed project site via the Boulder Valley Road. Light vehicles would pass through the haul road traffic control intersection as described above and turn north from the Boulder Valley Road onto the dedicated light vehicle lane leading to the security entrance.

2.3.5.4 Secondary Site Access

The existing road accessing the site from the Boulder Valley Road would become the secondary access road for limited use on an as-needed basis. The secondary access road location is shown in **Figures 2-2** and **2-3**. The secondary access road would be fenced and gated for controlled access.

2.3.6 Ancillary and Support Facilities

The following sections describe additional facilities supporting the Proposed Action.

2.3.6.1 Ancillary Facility Areas

Ancillary Facilities 1, 2, and 3 are located in the northern part of the proposed project boundary, as shown in **Figure 2-2**. Ancillary Facilities 4, 5, and 6 are located in the southern part of the proposed project boundary, as shown in **Figure 2-3**. These are relatively small areas of proposed disturbance occurring between major proposed facilities such as the WRDFs, processing facilities, and the open pit. These ancillary facilities would be used for support activities such as equipment storage, laydown yards, or temporary mining stockpiles.

2.3.6.2 Office/Shop Area

The 36-acre area located on the eastern side of the proposed project boundary would hold the office/administration building, the main truck shop, as well as a number of other support facilities, as depicted in **Figure 2-3**. As described in Section 2.3.5.3, Primary Site Access and Haul Road Traffic Control Intersection, the primary access road for light vehicles enters this area through the haul road traffic control intersection at the Boulder Valley Road. A security gate would control light vehicle access to the property.

The office building would be of standard modular construction to provide office spaces for various functions such as administration, safety, and technical support.

A truck shop and lube facility for conducting maintenance and repair of mobile equipment would be located in this area. Aboveground fuel storage tanks and a fueling station for vehicles would be located adjacent to the truck shop. The truck shop would consist of multiple work bays of various sizes to accommodate site mobile equipment, including haul trucks. The shop would include lubrication, fluids distribution, and equipment wash facilities.

The truck shop would include a warehouse and warehouse office spaces to support equipment and supply activities for the proposed project.

The office/shop area is on private land and would contain the following waste management facilities:

- A 90-day Hazardous Waste Storage Facility would be constructed and managed to Resource Conservation and Recovery Act (RCRA) guidelines.
- A septic system to receive sanitary waste water from the office/administration/shop area would be constructed and managed according to NDEP Bureau of Water Pollution Control regulations. The septic system would comply with applicable on-site sewage disposal program requirements. Preliminary tests indicate this area has adequate percolation to meet requirements. The septic leach field would be constructed approximately 350 feet from Boulder Creek, meeting the current regulation NAC 444.792 for a minimum distance of 100 feet from a stream or water course.

2.3.6.3 Electrical Power

NVEnergy Inc. currently supplies electrical power to the Dee Gold Mine site via a 69-kV power transmission line (ROW file NVN-038874) that presently terminates at an existing substation within the PoO boundary near the reclaimed office, mill, and shop area as shown in **Figure 2-1**. Under the Proposed Action, BDMV would build a new substation within the PoO boundary and replace approximately 4,800 feet of the existing power transmission line with a new 120-kV power transmission line to accommodate the proposed project facilities. The new power transmission line would be constructed with double wooden poles ranging in height between 65 and 100 feet ags depending on location and terrain. The existing substation and a portion of the existing power transmission line would be removed when no longer needed. The vacated section of the power transmission line (and corresponding ROW) would occur within the footprint of the proposed West WRDF.

Outside of the PoO boundary, a new power transmission line connection would be made to the existing high voltage line west of the project, as shown in **Figures 2-2** and **2-3**. Double wooden poles with height varying between 65 and 110 feet ags would be used for the new power transmission line connection. A 1-acre power connection yard would contain a fenced switch and equipment area at the point of connection to the existing NVEnergy high voltage power transmission line. NVEnergy would control the power transmission line corridor from the point of connection to the proposed PoO boundary and would determine final design parameters. The new line would feed the proposed substation located in the plant facility area, as shown in **Figure 2-3**.

The power connection yard outside of the PoO boundary and the substation (with voltage transformers) within the PoO boundary would be fenced with chain link 6 feet high with an additional 2 feet of barbed or razor wire to limit access. The power connection yard differs from a standard substation in that it does not include voltage transformers as part of the facility.

2.3.6.4 Communication and Water System Site

A communication and water system site and associated access road would be developed south of the proposed open pit, as shown in **Figures 2-2** and **2-3**. The proposed communication tower and water system site would be placed on a portion of the existing reclaimed WRDF that would not be otherwise affected by the Proposed Action (e.g., the site is outside the footprint of the West WRDF and the open pit).

Three voice and data communication towers and small utility buildings to house electrical equipment would be constructed at the site. The three towers would be 30 to 50 feet ags in height. Communications facilities would be licensed as required. The towers would be constructed to Federal Aviation Administration and Federal Communication Commission requirements for visual identification and airplane safety.

This site also would contain water tanks for process and potable water as discussed in Section 2.3.6.5, Water and Distribution System.

The site would have a power supply and utility buildings for equipment to support the communication and water distribution facilities.

2.3.6.5 Water Source and Distribution System

The estimated average freshwater consumption would be approximately 1,120 acre-feet per year (700 gpm), including process water, fire suppression water, and potable water. BDMV controls sufficient Nevada state water rights for adequate supply.

Water for the proposed site would be supplied from development of three wells located within the PoO boundary. The proposed location of the new wells is shown in **Figures 2-2** and **2-3**. Actual location of the wells would be based on hydrologic testing during construction.

A 100,000-gallon steel tank placed on soil fill would be constructed at the communication and water system site to store and distribute process water and fire suppression water. The process water/fire water tank would be supplied by the wells located to the south of the tank on Ancillary Facility No. 8 and Process Facility No. 2. A 20-foot-wide water pipeline corridor connecting the wells and the tank would cross the existing reclaimed WRDF for a distance of approximately 1,300 feet creating 1 acre of disturbance on the reclaimed WRDF. This southern pipeline would otherwise run within the proposed footprint of the West WRDF, ancillary facilities, and roads as shown in **Figure 2-3**. Another pipeline would run from the process water/fire water tank to the north to provide water to the office/shop area. This northern pipeline would run entirely within the proposed footprint of haul roads, ore stockpile and ancillary facilities as shown in **Figure 2-3**. Smaller pipes would be buried approximately 4 feet deep to prevent freezing. Larger lines would not be buried to allow access for maintenance.

Fire water lines would be fed from a Jockey Fire Pump to fire hydrants and fire systems at the processing plant facilities and office area. Fire water pipelines would be buried HDPE plastic lines approximately 4 and 12 inches in diameter.

A separate plastic potable water tank at the communication and water system site would receive water from a dedicated well or the process/fire water tank for drinking water supply. After appropriate treatment, potable water would be supplied to the processing plant and office/shop facilities area through HDPE lines. State permits would be acquired for potable water supply and distribution systems that meet or exceed standards for the number of users and connections.

2.3.6.6 Borrow Pits and Other Construction Material Sources

Construction material required for the heap leach pad secondary liner, as well as for other construction needs, would be salvaged during pre-stripping of waste rock in the open pit. If suitable material is not available within the pit, material would be excavated from existing clay borrow pits (see **Figure 2-1** for location), or from areas under the proposed WRDFs and the proposed heap leach pad footprint.

2.3.6.7 Chemical, Fuel, and Hazardous Material Storage

Transportation and handling of chemicals would be conducted by licensed carriers and properly trained workers in accordance with applicable regulations. Explosives would be delivered to the site by licensed haulers and stored on site at approved explosives magazine locations in compliance with applicable Department of Homeland Security, BATF, and MSHA regulations.

A spill contingency plan for the proposed project has been developed and submitted to BLM as part of the PoO (SRK 2009a). The proposed spill contingency plan is designed to prevent spill events and provide response, monitoring, and reporting procedures to spills if they were to occur. Additionally, the proposed spill contingency plan was developed to meet applicable regulations including reporting requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Spill Prevention, Control, and Countermeasure Plan of the Clean Water Act.

All liquid reagents would be trucked to the site and stored in specially designed, storage tanks that would be located within concrete secondary containment structures designed to contain 110 percent of the capacity of the largest tank within the containment area. Solid reagents would be trucked to the site and stored in bins or silos. Reagent storage and cleanup procedures would be implemented according to the spill contingency plan.

Table 2-9 presents the primary reagent, chemical, and fuel usage, storage, and load sizes anticipated for the proposed project. Approved staging facilities, safety measures, transportation, and handling requirements would be utilized.

Table 2-9 Primary Reagent, Chemical, and Fuel Usage

Substance	Annual Usage	Approximate Quantities Stored On-site	Storage Method	Amount per Load
Sodium Cyanide	500,000 gallons	40,000 gallons	Bulk Tanks	9,000 gallons
Sodium Hydroxide	50,000 gallons	3,000 gallons	Bulk Tanks	9,000 gallons
Diesel Fuel (No. 1 and 2)	15,000,000 gallons	90,000 gallons	Bulk Tanks	12,000 gallons
Ammonium Nitrate	40,000,000 pounds	300,000 pounds	Silos	60,000 pounds
Lime	40,000,000 pounds	200,000 pounds	Silos	60,000 pounds
Propane	40,000 pounds	20,000 pounds	Bulk Tanks	30,000 pounds
Antifreeze	24,000 gallons	10,000 gallons	Bulk Tanks	3,000 gallons
Gasoline	300,000 gallons	12,000 gallons	Bulk Tanks	3,000 gallons
Grease	10,000 gallons	3,000 gallons	Totes	500 gallons
Petroleum Oil	40,000 gallons	12,000 gallons	Bulk Tanks	3,000 gallons
Solvents	10,000 gallons	3.000 gallons	Tote, Drum	500 gallons
Emulsion	10,000,000 pounds	240,000 pounds	Silos	60,000 pounds
Miscellaneous Blasting Agents	600,000 pounds	60,000 pounds	Miscellaneous	20,000 pounds
Lignan-sulfonate	50,000 gallons	Varied	Bulk Tank	Varied
Magnesium Chloride	200,000 gallons	10,000 gallons	Bulk Tank	Varied

Source: BDMV 2011a.

Potentially hazardous wastes would be tested to determine their RCRA status and managed accordingly. Storage areas would be inspected and maintained in accordance with RCRA regulations. The proposed project would be categorized as a RCRA Small Quantity Generator.

A licensed contractor would be used to ship petroleum-contaminated soils (PCS) and truck wash sludge off-site to the appropriate disposal facility. No long-term storage of PCS is proposed for the project. PCS would be managed according to a PCS Management Plan to be prepared by BDMV prior to commencing operations.

Fuel (i.e., gasoline and diesel fuel), antifreeze, petroleum oils, and solvents would be trucked to the site in tanker trucks and transferred to aboveground storage tanks located in the office/shop area near the truck shop. The tanks would be located within spill containment structures designed to contain 110 percent of the capacity of the largest tank within the containment area as required by NDEP design requirements.

Explosives materials that would be transported to the site would include blasting agents (composed primarily of ammonium nitrate and fuel oil [transported separately]) and ignition devices. Blasting agents would be stored in appropriate storage bins separate from the explosive magazine. Blasting ignition devices would be stored in magazines that conform to federal and state regulations.

A proposed on-site Nevada Class III waivered Landfill would be located on the East WRDF as shown in **Figure 2-3** to dispose of non-hazardous, inert industrial waste. The proposed Class III waivered landfill would be permitted and managed according to NAC 444.731 regulations.

2.3.6.8 Fencing

A BLM approved 4-strand range fence, with 3-barb strands and a smooth bottom strand, would be constructed around the mine site to provide security, facilitate wildlife movement away from hazards in the project area, and exclude livestock from the active mining area as shown in **Figure 2-2**. The fence would enclose a total of 3,513 acres, of which 3,475 acres are public lands and 38 acres are private lands controlled by BDMV or affiliated company such as Barrick Gold of North America. The perimeter fence would cross the 90-foot-wide ROW for the existing 120-kV power transmission line (NVN-053160) as shown in **Figure 2-3**.

Additionally, in accordance with Nevada Department of Wildlife (NDOW) specifications, an 8-foot-high wire mesh fence would be constructed around the process solution pond to minimize exposure of wildlife to process solutions, as described in Section 2.3.4.5, Process Solution Collection System.

2.3.6.9 Storm Water Management Facilities

Storm water pollution prevention BMPs would be used to limit erosion and sediment transport from proposed facilities and disturbed areas during construction and operation in accordance with the NDEP General Storm Water Permit NVR300000. BDMV submitted an SWPPP for the Proposed Action to the BLM and NDEP as part of the PoO (SRK 2009a). The SWPPP would be updated prior to issuing the Final EIS.

The objective of the SWPPP would be to minimize the volume of potentially affected run-off from the proposed project, and to implement BMPs in accordance with NDEP guidelines. The SWPPP identifies the site's storm water pollution prevention team responsibilities, summarizes potential pollutant sources and describes BMPs that would be implemented for the Proposed Action. BMPs include good housekeeping practices, personnel training, erosion controls, diversion and sediment controls, maintenance of storm water management facilities, visual inspections, routine material handling and storage practices, and identification of major storm water control structures (e.g., diversion ditches and containment structures). The SWPPP also describes the storm water monitoring plan, annual evaluation procedures, record keeping, and the annual compliance report that would be submitted to NDEP in December of each year. BDMV would amend the SWPPP in accordance with the NDEP General Permit whenever there is a significant change in the facility that has the potential to effect storm water discharge or the SWPPP is determined to be ineffective in achieving the general objective of controlling pollutants in storm water discharging from the facility.

As described in the SWPPP, BMPs for erosion controls would include preservation of existing vegetation where possible, reclamation of completed areas of the WRDFs in accordance with the reclamation practices described in Section 2.3.8, Closure and Reclamation Plan, installation of diversion ditches upgradient and containment berms downgradient of the proposed WRDFs to control storm water run-on and run-off. Roads and parking areas within the PoO area and the Bootstrap Haul Road would be designed to utilize ditch and sediment basin systems that minimize impact to storm water. Dust suppression water and approved chemicals would be sprayed on roads and other disturbed areas at a rate that moistens the soil but does not cause run-off. The proposed Heap Leach Pad No. 12 and associated process facilities would be self-contained, synthetically lined, non-discharging facilities designed to contain leach material and solution in accordance with NAC 445A432. Facilities employ the design principle of 100 percent containment (zero-discharge) under both normal operating and specific emergency conditions (SRK 2009a).

BDMV has submitted a preliminary design report to BLM for storm water diversion structures to manage storm water from a 100-year, 24-hour storm event upgradient of the proposed Heap Leach Pad No. 12, the open pit, and the West WRDF (SRK 2011). The storm water management structures are shown in **Figure 2-2**. The storm water diversion ditch system upgradient of the proposed heap leach pad would divert storm water around the heap leach pad facility to existing drainages during operations and the post-closure period. A storm water pond is proposed upgradient of the open pit to limit overland storm water from entering the open pit and to limit infiltration into the pit walls. The open-pit storm water pond design includes installation of a 60-mil HDPE geomembrane liner to minimize infiltration and build-up of hydraulic head in the soil and rock above the pit wall. The open-pit storm water control pond would function only during operations and would be regraded and reclaimed during site closure. The West WRDF would have two catchment ponds built on the northern edge of the dump that would function during operations and the post-closure period. The outer pond embankments would ultimately be buried beneath the waste rock such that West WRDF slopes would drain directly into the ponds at the ultimate build out of the West WRDF. The West WRDF storm water ponds and the pond proposed upgradient of the open pit would be subject to the state dam regulations (NAC 535) and BDMV would submit a dam permit application to the Nevada Division of Water Resources for the facilities as required by regulations during detailed design.

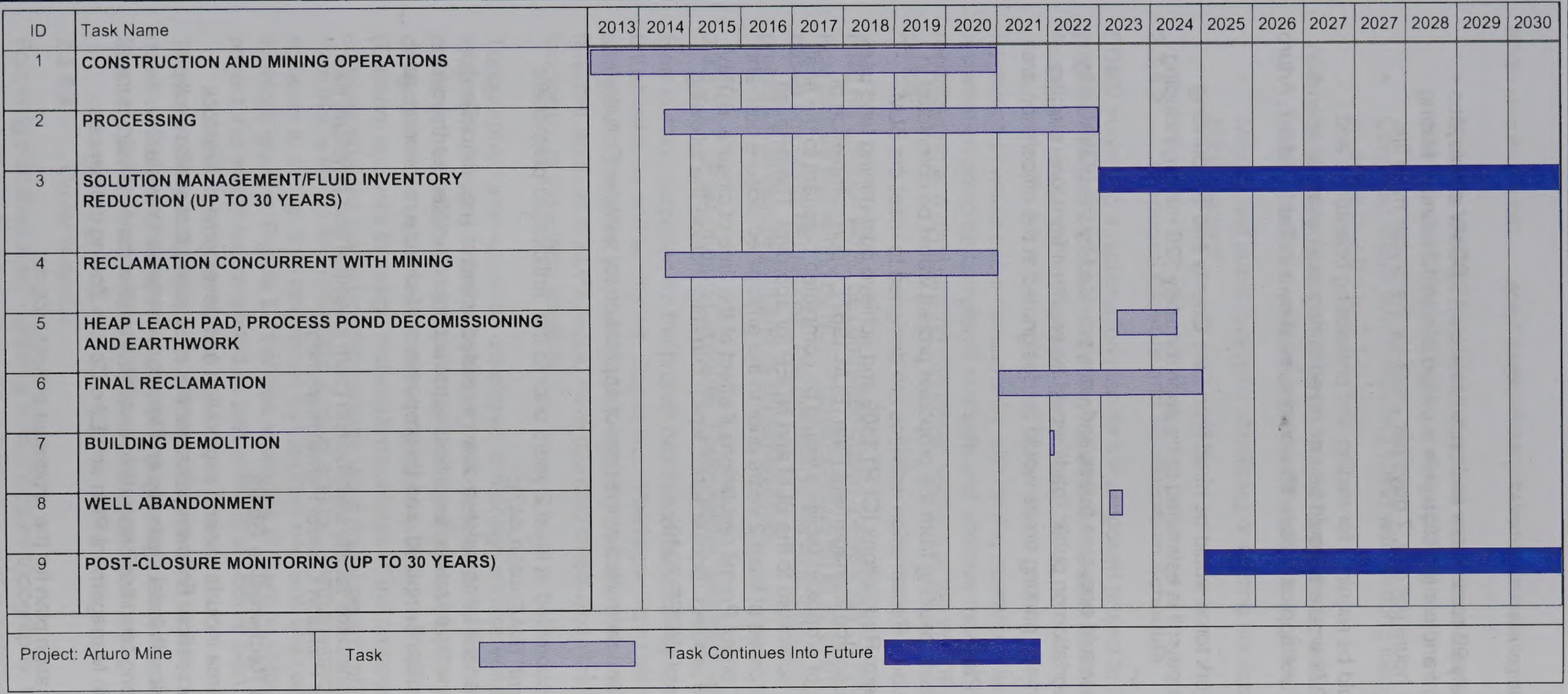
Facilities would be monitored following spring snowmelt and intense rain events to ensure that drainage and sediment control measures are effective and operating properly. BDMV would monitor all sediment ponds and basins in accordance with the SWPPP and the Nevada General Storm Water Permit for Mining operations. Maintenance and repairs would be performed as needed. Sediments would be removed prior to the impounding design capacity of the facility being reduced by 50 percent.

2.3.6.10 Exploration

Surface exploration for geologic evaluation is proposed on approximately 161 acres within the PoO boundary. As indicated in **Table 2-2**, the exploration areas overlap with the disturbed area of other proposed facilities. The proposed geologic evaluations would continue for the previously permitted surface exploration programs listed in **Table 2-1** and described in Section 2.2.3, Existing Facilities. The proposed surface exploration disturbance would consist of drilling, trenching, seismic lines, and road construction.

2.3.7 Schedule and Work Force

A summary of the proposed mining, processing and reclamation schedule is provided in **Figure 2-10**. This timeline is approximate based on current assumptions and would be adjusted depending on mining and economic conditions in the future. Construction of proposed project facilities is planned to begin in 2013 pending authorization of permits and approvals. Mine operations would begin within 12 months of the start of construction, continuing for approximately 8 years. Ore processing would continue for an additional 2 years beyond the end of mining operations. Reclamation would occur concurrently with mining to the extent possible. Final reclamation would be completed during a 4-year period following cessation of mining. Post-closure monitoring by the NDEP-BMRR could continue up to 30 years following completion of reclamation based on current regulations. The duration of the BLM's post-closure monitoring would depend on the project's final closure plan and its implementation.



Note: Timeline is approximate and subject to change based on permitting schedule and mining/economic conditions.
Source: BDMV 2012.

05/31/12

Dee Arturo Expansion Project

Figure 2-10

Proposed Project Schedule

A construction work force of approximately 90 contractors and approximately 10 BDMV employees would be required for facility development and construction over a period of 8 to 12 months. Mining operations would be conducted up to 24 hours per day, 7 days per week for the 8-year mine life.

On average more than 200 workers would be required for mining and processing operations and concurrent reclamation activities. Up to 379 workers would be employed during peak years of operation. The final years of reclamation would require approximately 15 workers, as shown in **Table 3.10-7**, Arturo Mine Project Employment by Year.

It is anticipated that the majority of the work force would be hired from Elko County and surrounding areas. The annual operations work force payroll is estimated to be approximately $20 million, including benefits.

Employee transportation to the mine site would occur via buses and vans provided by the BDMV or by employee-owned vehicles. Group transportation on public roads would be provided from local staging areas in the towns of Elko and Carlin. On-site parking areas would be designated at the office/shop area.

2.3.8 Closure and Reclamation Plan

Reclamation and closure of disturbed areas resulting from the proposed project would be completed in accordance with BLM and NDEP regulations. Reclamation activities are designed to meet the BLM regulations contained in 43 Code of Federal Regulations (CFR) 3809 and achieve post-mining land uses consistent with the Elko District Office Resource Management Plan (BLM 1987). Upon completion of operations, final closure and reclamation of proposed facilities would be completed pursuant to the final closure plan and schedule that would be submitted to the BLM and NDEP for approval. The detailed closure plan for each facility would be prepared at least 2 years prior to the anticipated closure date and would conform with the Water Pollution Control Permit regulations if effect at the time of closure. BDMV would conform to the NDEP mine closure process requirements, which currently include the following closure plan submittals for agency approval (NDEP 2010):

1. Tentative Permanent Closure Plan - submitted at the time of application for a Water Pollution Control Permit (NAC 445A.398);
2. Final Permanent Closure Plan - submitted at least 2 years prior to the "anticipated permanent closure of that process component" (NAC 445A.447);
3. Final Closure Report - (a) summarizes all completed closure-related activities (i.e., detoxification of the heap; monitoring; facility characterization; leachfield construction; completed earthwork); (b) provides closure related as-builts, if required; and (c) proposes post-closure monitoring, as applicable; and
4. Request for Final Closure - demonstrates facility stabilization (both chemical and physical) has been achieved and solicits Water Pollution Control Permit retirement.

2.3.8.1 Post-mining Land Use and Reclamation Goals

Major land uses occurring in the project area include mineral exploration and development, livestock grazing, wildlife habitat, and dispersed recreation. Following closure, it is anticipated that similar multiple land uses would occur. BDMV would work with local agencies and local governments to evaluate alternative land uses that could provide long-term socioeconomic benefits from the mine infrastructure in conformance with the Elko BLM Resource Management Plan and Elko County Zoning ordinances.

The objectives for the closure and reclamation plan for the proposed project include:

- Provide a stable post-mining landform that supports defined land uses, such as wildlife habitat and domestic grazing;

- Minimize erosion damage and protect water resources through prevention of adverse fluid drainage (including acid rock drainage [ARD]) and from the facility;
- Construct stable land forms that blend with existing topography with final slopes not to exceed an angle of 2.5:1 to 3:1 overall;
- Establish post-reclamation surface soil conditions conducive to the regeneration of a stable, diverse, noxious weed-free plant community compatible with land use goals; and
- Maintaining public safety by stabilizing or limiting access to landforms that could constitute a public hazard.

2.3.8.2 Proposed Closure and Reclamation Schedule

BDMV submitted a reclamation plan for the proposed project to the BLM in the PoO (SRK 2009a). The proposed project schedule, including reclamation, is discussed in Section 2.3.7, Schedule and Work Force, and presented in **Figure 2-10**.

Reclamation would occur concurrently with mining operations as areas become available and when reclamation could be completed in a safe and effective manner. Concurrent reclamation would include recontouring and revegetating completed sections of the WRDFs incrementally during the operating period.

Final reclamation would be completed during a 4-year period following cessation of ore processing. Post closure monitoring by NDEP could continue up to 30 years following completion of processing based on current regulations. The duration of the BLM's post-closure monitoring would depend on the project's final closure plan and its implementation.

2.3.8.3 Post-mining Contours, Topography, and Regrading

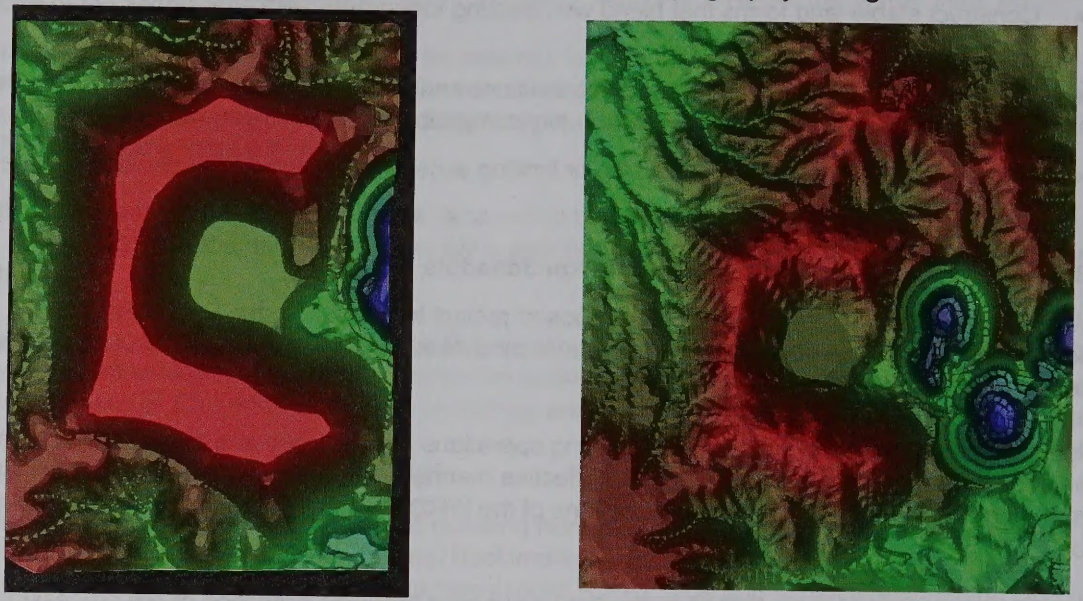
Final grading proposed for the project facilities would provide stability and minimize the visual impact of unnatural lines and landforms. Slopes would be regraded to blend with surrounding topography, interrupt straight-line features, and facilitate revegetation, where practical. Large constructed topographic features, such as WRDFs, would have rounded crests and variable slope angles to resemble natural landforms, to the extent possible.

Topographic forms would be developed to manage surface water and moisture appropriately over the long term. Designs to prevent ponding and snow accumulation would be implemented on facilities where prevention of water infiltration is important. For the final closure plan, BDMV would refine preliminary design contours using a reclamation topography design software such as Carlson Natural Regrade® (Carlson) software to design reclamation contours of the proposed facilities. Topographic design software enables stable landform design using fluvial geomorphic principles that can result in a final land form that is stable and minimizes erosion and long-term maintenance requirements. BDMV has used this software to design final land forms that support end land use requirements such as wildlife habitat and livestock grazing. **Figure 2-11** shows examples of Carlson software reclamation design for the proposed project that would be completed as part of the final closure plan.

The preliminary design contours of the reclaimed mine facilities are presented in **Figure 2-12**. Additional detail on the post-mining contours and topography for individual facilities are discussed in Section 2.3.8.6, Reclamation of Proposed Project Facilities.

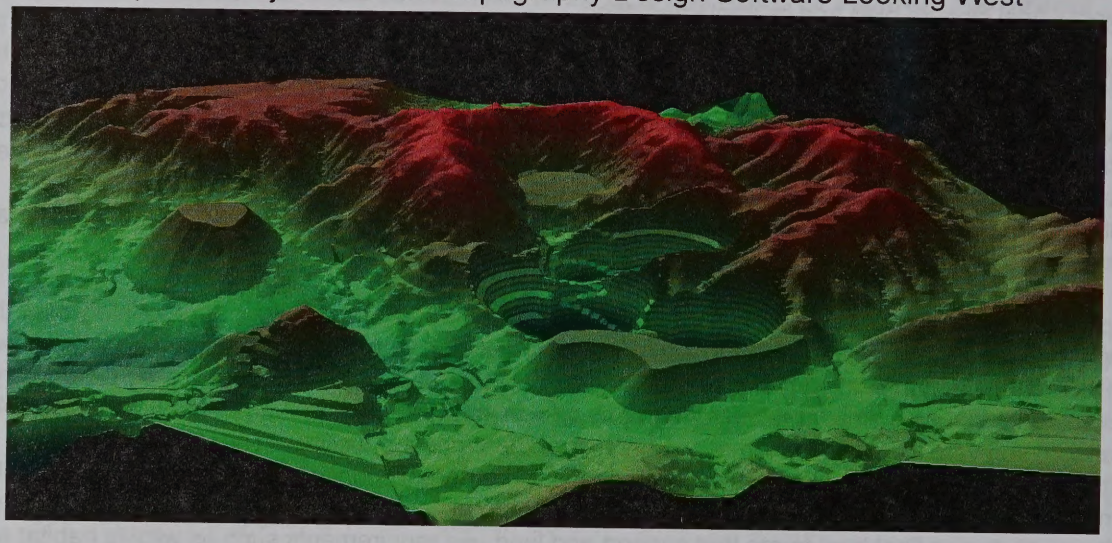
2.3.8.4 Cover Material

Following disturbed area regrading to final closure topography, facilities would be covered with a simple conventional cover of growth media to support overall vegetation goals and protect water and air resources. The cover would be composed of on-site soil salvaged during mine development and suitable unconsolidated waste rock excavated during mine operations or the reclamation period. Based on



West WRDF Design Without Topography Design Software

West WRDF Design With Topography Design Software



Proposed Project Site with Topography Design Software Looking West

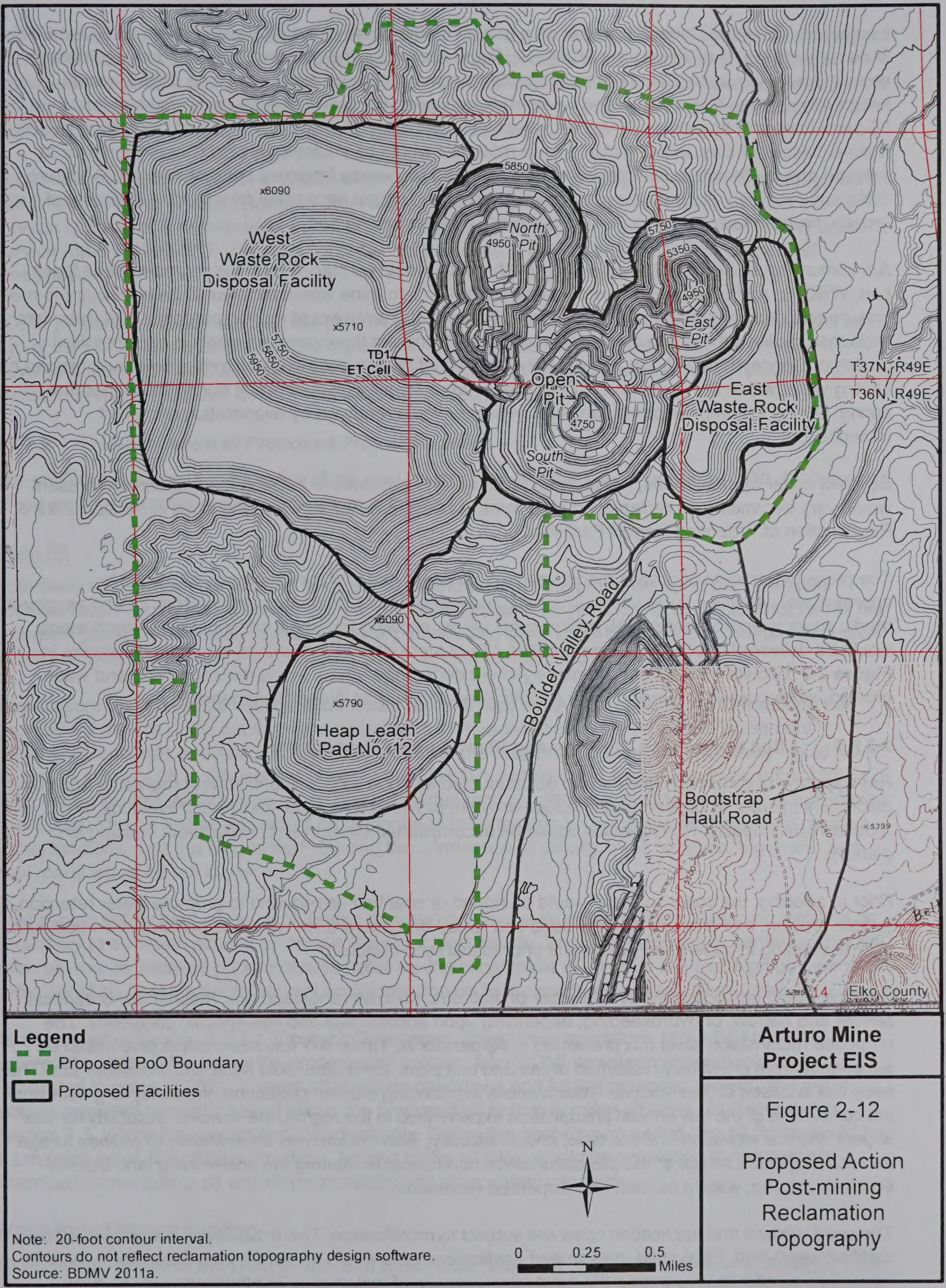
Arturo Mine Project EIS

Figure 2-11

Example Output of Reclamation Topography Design Software

Source: BDMV 2011a.

05/16/12



Arturo Mine Project EIS

Figure 2-12

Proposed Action Post-mining Reclamation Topography

Note: 20-foot contour interval.
Contours do not reflect reclamation topography design software.
Source: BDMV 2011a.

5/20/2012

successful use of the Carlin Formation as a growth media cover at the proposed project site (Dee Gold Mine reclamation) and the nearby BGMI AA Heap Leach Pad, the primary source of unconsolidated cover material would be Carlin Formation material removed during open-pit mining. BDMV would selectively salvage Carlin Formation waste rock for use as the growth media cover that has less than 35 percent coarse fragments by volume; and excludes United States Department of Agriculture (USDA) texture classes of clay and silty clay. These materials would be selected by field observation prior to salvage and confirmatory samples would be analyzed for coarse fragment content and USDA texture class and recorded. Regraded surfaces would be ripped where necessary prior to the placement of growth media to reduce compaction and provide a uniform seed bed.

A minimum cover depth of 24 inches of growth media would be placed over the regraded heap leach pad, WRDFs, and other areas where limiting infiltration into mine waste rock would be necessary to meet closure and reclamation goals. The 24-inch growth media cover would reduce percolation of water into reclaimed facilities through a combination of cover depth and the evapotranspiration of plants. Soil covers of this depth have been demonstrated to limit infiltration once vegetation has been established by storing water within the upper layers of the cover when vegetation is dormant during the winter and spring. During the warmer growth season, moisture would removed by evaporation and plant transpiration.

Depth of cover for haul roads, roads, lined facilities, and sites where building foundations are present would vary depending on reclamation objectives, as described for individual facilities in Section 2.3.8.6, Reclamation of Proposed Project Facilities.

The projected amount of growth media required for cover material for the proposed project is approximately 4 million cubic yards. The estimated amount of Carlin material available for use as growth media cover is approximately 110 million cubic yards, allowing for ample contingency. Growth media would be delivered directly to the reclamation site or stockpiled in designated locations, as shown in **Figure 2-2**. Growth media stockpile management during operations would minimize wind and water erosion, as discussed in Section 2.3.9.8, Soils, Vegetation, and Weed Management.

2.3.8.5 Soil Preparation, Seeding and Planting, and Revegetation

Revegetation of disturbed areas would be conducted as soon as practical following regrading and cover placement in order to control runoff, reduce erosion, provided forage for wildlife and livestock, and reduce visual impacts. Revegetation would be accomplished through soil preparation, seeding and planting.

Prior to seeding, the cover material would be ripped or scarified as required to promote water retention, reduce erosion, and prepare the final seed bed. Seed bed preparation would be performed immediately prior to seeding to allow seed placement prior to soil recompaction.

Seeding would be conducted by a number of methods, such as rangeland drill, mechanical broadcast seeder and harrow, or hydroseeding, depending upon accessibility and site-specific conditions. The proposed reclamation seed mix presented in **Appendix A**, **Table A-1** has been developed based on experience from previously reclaimed areas and test plots at the Dee Gold Mine and the BGMI site. The seed mix is based on the species' effectiveness in providing erosion protection, the ability to grow within the constraints of the low annual precipitation experienced in the region, the species' suitability for site aspect, the site elevation and soil type, and availability. This mixture has been shown to provide forage and cover species similar to the pre-disturbance conditions, facilitating the post-mining land uses of livestock grazing, wildlife habitat, and dispersed recreation.

The seed mixture and application rates are subject to modification. The actual seed mixture would be certified weed-free. Final seed mixture and application rates would be determined immediately prior to reseeding in order to incorporate the most recent results of reclamation in other areas of the mine, concurrent reclamation, revegetation test plots, or changes to the BLM seed mix recommendations.

Seed mix and application rates also may need to be modified as a result of limited species availability or poor seed quality. A list of alternate plant species that could be used in the reclamation seed mix is provided in **Appendix A**, **Table A-2**. Additionally, more than one seed mix may be used on the project to provide plant diversity, and seedling plants for some species may be planted in lieu of seeding. Modifications would be undertaken with the concurrence of the BLM.

Successful revegetation status would be determined by the BLM and NDEP-BMRR in cooperation with BDMV during the post-closure period. The Nevada Guidelines for Successful Revegetation for the Nevada Division of Environmental Protection, the Bureau of Land Management and the USDA Forest Service (IM-NV-1999-013) would be consulted for guidance in determining criteria for successful revegetation.

BDMV prepared a weed management plan for the proposed project that was submitted to the BLM as part of the PoO. The weed management plan is in conformance with Chapter 555 of the Nevada Revised Statute and NAC and is discussed as an applicant-committed environmental protection measure in Section 2.3.9.8, Soils, Vegetation, and Weed Management.

2.3.8.6 Reclamation of Proposed Project Facilities

The preliminary design configuration of the post-mining land forms is shown in **Figure 2-12**. Descriptions of reclamation for major facilities are provided below.

Open Pit

Potentially economic mineralization is known to extend beneath the proposed open pit. To enable potential future recovery of these resources, backfilling waste rock into the proposed pit is not part of the proposed project. Additionally, slope angles of pit walls and benches at closure would not be conducive to soil placement or revegetation practices due to access, safety, and logistics concerns.

Post-closure open pit slope configuration would be controlled by several parameters that include the geometry of the ore body, geologic and geotechnical characteristics of the host rock, equipment constraints, and safe operating practices. The walls of the proposed pit at closure generally would have an overall slope of 26 to 58 degrees (steeper than 2H;1V). Actual slope angles would be subject to engineering studies, MSHA regulations and guidelines, and conditions encountered during actual mining operations. The pit wall angles would be designed to fail after closure within the pit footprint to create a stable landform over the long term. Following the completion of mining, in-pit benches, highwalls, and haul roads would be left in place.

Post-mining safety barriers, such as berms, fencing, or other appropriate barriers, would be installed as necessary to eliminate access by people, livestock, and wildlife. Some of these safety barriers within the open pit may be installed prior to closure, after mining is complete in an area. A 4-foot-high pit perimeter berm would be constructed to prevent accidental access to the predicted pit wall failure zone.

As discussed in Section 2.3.2.1, Open-pit Dewatering, dewatering operations at the BGMI site have lowered the water table below the proposed pit bottom. After BGMI dewatering operations cease (estimated to occur in 2021, 2 years after mining operations end for the proposed project), the water table is expected to rise to a level above the proposed pit bottom forming pit lakes, as discussed in Section 3.3, Water Resources and Geochemistry. During the post-closure period, the pit floors would be submerged when the pit lake develops. Access to the pit lakes would be prevented by the barriers described above due to pit wall slope instability and other safety concerns.

Waste Rock Disposal Facilities

The benched slopes of the West WRDF and East WRDF would be regraded to an overall average slope of 3H:1V, except for areas of steep underlying topography where slopes would be regraded to 2.5H :1V. This slope angle range has been demonstrated to effectively limit surface water runoff velocities and erosion. Carlson (or equivalent) software would be used to refine the preliminary design WRDF configuration as described in Section 2.3.8.3, Post-mining Contours, Topography, and Regrading, in order to meet the reclamation goals for stable slopes, mass stability, limited infiltration, rounded edges to minimize visual impacts, revegetating surfaces, and erosion control. BDMV has incorporated information from the existing reclaimed WRDF at the site that has demonstrated stability since 2001 into the design of the proposed WRDFs. Consideration was given to provide for mule deer wildlife habitat on the reclaimed facilities. Storm Water management facilities (including the ponds located upgradient of the West WRDF, TD1 ET cell, and smaller bermed areas) would provide wildlife access to water periodically when storm water is present.

The preliminary design of the WRDFs has been evaluated for stability as described in Section 3.3, Geology and Minerals. The final closure plan for the WRDFs would include confirmation of long-term stability. At the time of closure, the WRDF configuration would reflect the material placement practices during operations where the WRDFs would be constructed in lifts ranging from 50 to 150 feet, with some slopes standing at the natural angle of repose (approximately 33 degrees or 1.5H:1V). The WRDFs would be constructed using a lift/bench approach designed to approximate the post-reclamation configuration. Sufficient bench setbacks would be provided during construction to provide for regrading activities. As described in Section 2.3.3, Waste Rock Disposal Facilities, the West WRDF has been designed to accommodate burying TD1 in place. The final topography of the West WRDF will reflect the restriction on the waste rock placement depth over TD1 (maximum of 50 feet) on top of TD1 and the avoidance of the TD1 ET cell as shown in **Figure 2-12**.

Reclamation of the WRDFs would be conducted concurrently with regular mine operations to the extent possible. As sections of the WRDFs reach the ultimate configuration and become inactive, the slopes would be regraded to final slope angle. Upon completion of the regrading of a portion of the WRDFs, growth media would be hauled from stockpile locations and placed over the recontoured surface, as described in Section 2.3.8.4, Cover Material.

The growth media thickness would be a minimum of 24 inches for all areas. As described in Section 2.3.3, Waste Rock Disposal Facilities, waste rock place in the WRDFs would be managed in accordance with the waste rock management plan prepared by Schafer and submitted as part of the PoO (SRK 2009a). PAG material would be encapsulated in non-PAG waste rock as described in Section 3.4, Water Resources and Geochemistry. The final topography of the WRDF, as well as the area of the West WRDF covering TD1 would be constructed to eliminate ponding and further reduce infiltration. The final closure plan for the WRDFs would include any detailed adjustments to the preliminary design necessary to ensure the effectiveness of the cover.

The approved seed mix would be applied following cover placement, as described in Section 2.3.8.5, Soil Preparation, Seeding, Planting, and Revegetation. To minimize erosion until vegetation has re-established, silt fences, sediment traps, or other appropriate storm water BMPs would be implemented, as necessary.

Heap Leach Pad Facility

Heap Leach Pad No. 12 would be reclaimed with slopes averaging 3H:1V. During operations the Heap Leach Pad would be constructed in operational lifts with setbacks approximating final contour for efficient reclamation. Carlson (or equivalent) software would be used to refine the preliminary design of the heap leach pad final configuration as described in Section 2.3.8.3, Post-mining Contours, Topography, and Regrading, in order to meet the reclamation goals for stable slopes, mass stability, limited infiltration, rounded edges to minimize visual impacts, revegetating surfaces, and erosion control. The preliminary design of the heap leach pad final shape has incorporated information from the existing heap leach pad closures at the site that have demonstrated stability and acceptable draindown control since 2001. The closure plan for Heap Leach Pad No. 12 includes the following activities:

- Chemical Stabilization. Prior to closure, active cyanide addition to the heap leach pad would cease. Heap solution would be recirculated to reduce free cyanide. The overall quantity of solution circulating through the heap would be reduced by evaporation. Stabilization of the heaps is defined under NAC 445A.430 and 431 and is generally summarized as not having the potential to degrade waters of the state.
- Regrading for Stability and to Promote Runoff, Reduce Infiltration, and Control Erosion. Heap leach pad facility reclamation activities would commence once chemical stabilization of the spent heap material is achieved and the heap leach pad surface is no longer needed for fluid management. The heap leach pad facility would be constructed in lifts as determined by design and operational considerations. The lifts generally would be constructed to allow an overall final reclamation slope of 3H:1V. This design would mitigate aesthetic impacts, provide stability, promote runoff, and reduce infiltration. When no longer required for evaporation of fluids, the surface piping would be removed, and side-slopes would then be regraded to match closely with the crest of the perimeter collection ditches in preparation for the placement of ET cover material.
- Cover. The cover thickness for the heap leach pad would be 24 inches. Revegetation of the heaps would occur following growth media placement, as discussed in Section 2.3.8.5, Soil Preparation, Seeding, Planting, and Revegetation. To minimize erosion until vegetation has been re-established, silt fences, sediment traps, or other appropriate BMPs would be installed, as necessary. In addition, storm water diversion structures constructed upgradient of the heaps prior to operation would be retained to minimize erosion over the long term.
- Treatment of Outflows, Residual Chemicals, or Fluids in the Heap. As the heap leach pad is stabilized and closed, the long-term heap drainage would be routed to an evaporation cell or an ET cell to further reduce or eliminate the discharge from the system. The combination of limiting infiltration into the heaps and removing inventory through evaporation would be employed to provide an ecologically safe long-term closure of the heaps. It is anticipated the use of evaporation and ET technologies will result in no discharge requiring treatment. Actual results would be monitored during the post-closure period and alternative use or treatment of the fluids would be developed if required.

The heap leach pad facility would be decommissioned in accordance with NDEP and 43 CFR 3809.420 regulations and guidelines for closure. A final closure plan would be prepared and submitted to NDEP and BLM to provide for any detailed adjustments to the preliminary heap leach pad design to ensure ET effectiveness, as required by regulations (NAC 445A.430 through 445A.447).

Process Solution and Storm Water Event Ponds

At closure, one or both of the storm water event ponds would be converted to a long-term, post-closure fluid management facility. The observed draindown period for the last heap leach pad closed within the project area (Heap Leach Pad No. 11) was 12 months, during which draindown decreased from 300 to 2 gpm (SRK 2009a). Based on this observed draindown, the time required to drain the proposed heap leach pad is conservatively estimated at approximately 2 years; however, draindown time may vary depending upon operational and weather conditions. Excessive precipitation could increase heap leach pad draindown times. Solution management/fluid inventory reduction activities are planned conservatively for up to 30 years, as shown in the proposed project schedule (**Figure 2-10**).

To convert the storm water event ponds into post-closure fluid management ET cells or evaporation basins, a detailed engineering design would be submitted as part of the final closure plan for review by the NDEP and BLM prior to construction. Before conversion, an independent quality assurance inspector would be employed to inspect the existing liner, monitor the activities, and order remedial actions, if necessary. Generally, the pond liner would be left in place and protected with a 2-foot overliner layer of earthen material. Required fluid distribution piping would be installed, and the pond(s) would be configured appropriately to serve as ET cells or evaporation basins for the time period specified in the final closure plan. The converted facilities would be alluvium filled to eliminate wildlife contact with water.

The process solution pond could potentially be converted to an ET Cell or evaporation basin if necessary to manage post-closure fluid. The conversion process for the process solution pond would be similar to that described above for the storm water event ponds.

In the case where the process solution pond is not necessary for long-term water management (because one or more of the storm water event ponds is sufficient to manage draindown fluid), the process pond would be decommissioned. Following heap draindown, the remaining water in the process pond would be allowed to evaporate. Solids would be present in some quantity in the pond at the time of closure. Representative samples of the solids would be obtained and analyzed by the MWMP to determine the chemical characteristics. Depending on the results of the characterization testing, the solids would be left in the pond and buried in place, removed for gold recovery, or removed and placed upgradient on the heap leach pad facility prior to final closure. To reclaim the process pond, the process pond liners would be cut, folded, and disposed of in the pond bottom prior to backfill and reclamation of the pond. If the final closure plan determines solids would remain in place, excess water would be removed and the liner would be folded in on the solids. A minimum of 5 feet of fill would be placed over liners to prevent liners from rising to the surface in the long term. The pond embankments would be dozed in on the solids, and the pond would either be backfilled or regraded to ensure free drainage from the final surface. The recontoured surface would be seeded.

If not required for long-term draindown management, reclamation of a storm water event pond would be accomplished in a similar manner to that described above for the process solution pond, although it would be less likely that substantial quantities of sediment would be present.

Roads

Within the proposed project areas, roads and safety berms would be recontoured or regraded to blend with the surrounding land form. Recontoured slopes would be similar to the surrounding topography.

Compacted road surfaces would be ripped prior to reclamation, covered with growth media from the safety berms or road fill, and revegetated. Dikes and ditches no longer required would be regraded, and unneeded culverts would be removed.

Remaining exploration and access roads would be recontoured and revegetated once they were no longer needed. A minimum of 6 inches of growth media cover would be placed over closed road areas. Trenches would be backfilled, recontoured, and seeded. Some access roads may be needed to access monitoring points, but they would be recontoured and revegetated when no longer needed.

Building and Support Facilities

During final mine closure, buildings and structures would be dismantled as required by the post-mining land use objectives, and materials would be salvaged, removed to the proposed on-site Class III waivered landfill, or transported to a permitted landfill located off-site. In accordance with reclamation plans presented in recent EISs for gold mines in the Carlin Trend (BLM 2010a,b), concrete foundations and slabs would be broken up or otherwise arranged to prevent ponding where possible and buried in place under 5 feet of cover. Where foundations were left intact, they would be buried under 10 feet of cover. The disturbed areas would be revegetated after demolition, salvage operations, and cover placement was completed.

Remaining reagents and explosives would be removed for use at other mines or disposed of at a licensed off-site facility. Above-surface pipelines would be removed and properly disposed of off-site. Underground pipeline ends would be capped and left in place under the 4 feet of cover placed at the time of construction or during the final reclamation period. Unneeded utility poles would be cut off at ground level and disposed of at an approved off-site location or in the proposed on-site Class III waivered landfill.

Drill Hole Plugging and Water Well Abandonment

Mineral exploration and development drill holes as well as monitoring, production, and dewatering wells subject to Nevada Division of Water Resources regulations would be abandoned in accordance with applicable rules and regulations (NAC 534.425 through 534.428). Boreholes would be sealed to prevent cross-contamination between aquifers, and the required shallow seal would be placed to prevent contamination by surface access.

Monitoring wells would be maintained until BDMV is released from post-mining groundwater monitoring requirements by the NDEP-BMRR and BLM. These wells then would be plugged and abandoned in accordance with the applicable requirements.

Surface Facilities or Roads Not Subject to Reclamation

Roads and some buildings on private land may remain, as consistent with post-mining land use objectives.

2.3.8.7 Surface Water Best Management Practices and Erosion Controls

The conceptual closure plan includes industry practice BMPs for storm water management similar to those described in Section 2.3.6.9, Storm Water Management Facilities, such as regraded slope angle, placement of growth media, and revegetation to limit erosion and reduce sediment run off following precipitation events in the proposed project area.

Surface water would be diverted around the open pit by storm water diversion berms and/or ditches to be installed during the closure period. The lined storm water pond located up gradient of the open pit would be closed and reclaimed after the cessation of operations. The storm water diversion ditch upgradient of the proposed heap leach pad and the two storm water catchments located up gradient of the West WRDF would remain in place after the cessation of operations to manage storm water during the post-closure period.

According to a final closure plan to be prepared 2 years prior to closing the facilities, BDMV would install and maintain silt fences, sediment traps, and other appropriate BMPs to prevent migration of eroded material until vegetation has been established, and reclaimed slopes and exposed surfaces have demonstrated erosion stability.

2.3.8.8 Measures to be taken During Extended Periods of Non-operation

In the event that continuous, full-scale production is interrupted due to economic considerations or unforeseen circumstances, interim reclamation may be initiated. Interim reclamation would include the following actions:

- Power transmission lines - the power transmission line would be inspected regularly and maintained as necessary;
- Roads - the main access road would be maintained as necessary;
- Open Pit - berms or fences would be placed to help restrict access to bench face areas;
- Erosion Control Measures - erosion control measures and BMPs would be regularly inspected and maintained; and
- Buildings - buildings, equipment, and support facilities would be protected from public access and maintained as necessary.

Per NAC 519A.320(2), BDMV would notify the BLM and NDEP-BMRR in writing within 90 days after a production suspension that is anticipated to last longer than 120 days. BDMV would identify the nature and reason for the suspension, the duration of the suspension, and anticipated timing of resumption of mining or the closure of the site.

2.3.8.9 Post-closure Monitoring and Maintenance

Following mine closure and reclamation, fence and sign maintenance, site inspections, and storm water control facility maintenance would continue for the period of reclamation responsibility. Monitoring for noxious weeds and revegetation success would be conducted until the revegetation standards have been met as determined by the BLM and NDEP-BMRR.

Post-closure groundwater quality would be monitored according to the requirements established by NDEP upon approval of the Water Pollution Control Permit. The final closure plan submitted at least 2 years prior to the anticipated closure date would serve as the basis of the post-closure monitoring plan. Post-closure monitoring by NDEP could continue up to 30 years following completion of processing based on current regulations. The duration of the BLM post-closure monitoring would depend on the project's final closure plan and its implementation.

2.3.9 Applicant-committed Environmental Protection Measures

During construction and operation of the proposed Arturo Mine Project, BDMV would implement applicant-committed measures to minimize or mitigate impacts to air, land, water, wildlife, and cultural resources and to prevent undue or unnecessary degradation of the environment as part of the proposed project's standard operating procedures. The following sections describe BDMV applicant-committed measures. Some of the measures are mandated by regulatory requirements while others are project specific. All applicant-committed measures would comply with appropriate federal and state requirements including air quality, water quality, hazardous waste, and solid waste standards.

2.3.9.1 Cultural Resources

A total of 29 archaeological sites eligible for inclusion on the National Register of Historic Places that cannot be avoided by project construction would be or have been mitigated through implementation of a Historic Properties Treatment Plan and in accordance with the Memorandum of Agreement developed by the BLM Elko District Office in consultation with the Nevada State Historic Preservation Office (SHPO) as discussed in Section 3.5, Cultural Resources. There would be an opportunity for Native American monitors to be present during data recovery. The BLM and SHPO-approved Historic Properties Treatment Plan would be implemented prior to the BLM issuing a notice to proceed.

If human remains/burials or previously unidentified cultural resources are discovered during ground-disturbing activities associated with the proposed project, BDMV would immediately cease activities within 300 feet of the discovery, ensure that the discovery is appropriately protected, and immediately notify the BLM Authorized Officer by telephone, followed by written confirmation. Work would not resume and the discovery would be protected until the BLM Authorized Officer issues a Notice to Proceed.

BDMV would take care to ensure that employees, contractors, or others associated with the proposed project do not damage, destroy, or vandalize archaeological and historical sites or the artifacts within them.

2.3.9.2 Survey Monuments

To the extent practicable and economically and technically feasible, survey monuments, witness corners, and/or reference monuments would be protected against unnecessary or undue destruction, obliteration, or damage. Public land survey system monuments would be protected and preserved in accordance with Nevada BLM (IM-NV-2007-003). If, in the course of operations, monuments, corners, or accessories are destroyed, BDMV would immediately notify the BLM Authorized Officer.

2.3.9.3 Spill Prevention and Emergency Response

The proposed project would comply with the statutes governing spill prevention and emergency response including the Clean Water Act, Section 311; CERCLA, Section 103; Emergency Planning and Community-Right-to-Know Act of 1986; or Title III of the Superfund Amendments and Reauthorization Act, Section 304. Examples of measures taken to address the requirements include:

- BDMV would notify appropriate federal, state and local agencies of the facility status, as required under the regulations.
- BDMV would submit copies of Material Safety Data Sheets, a list of those materials defined as hazardous under the Occupational Safety and Health Administration (Hazard Communication Standard that are present in excess of 10,000 pounds or in amounts greater than the threshold planning quantities for extremely hazardous substances, and other required documents to state and local emergency planning committees and local fire departments.
- BDMV would submit to the State Fire Marshall an annual inventory of regulated materials stating the maximum amounts of those materials stored on the property at any given time throughout the calendar year, estimates of average daily amounts of those materials, and document the location of those materials at the facility. Reporting, notification, and other plans supplied to the local, state, or federal authorities under Emergency Planning and Community-Right-to-Know Act would be made available to the public.
- If a hazardous substance is released in an amount greater than the CERCLA-established reportable quantity, BDMV would report the release to the National Response Center and to state and local authorities, as required by the regulations.
- BDMV submitted a spill contingency plan as part of the PoO (SRK 2009a). The spill contingency plan would be maintained and updated, as needed, throughout the life of the proposed project. This plan describes the system that would be used for the prevention, response, containment, safe cleanup, and reporting of spills or discharges of substances that potentially may degrade the environment. The procedures outlined in this plan would apply to potential leaks and spills that would remain within the boundary as well as spills that would flow off-site.
- Chemicals would be stored and handled in accordance with manufacturer's recommendations and state regulations. The Material Safety Data Sheets for chemicals used at the proposed project would be kept at locations that are accessible to the working personnel in accordance with the Occupational Safety and Health Administration Hazard Communication Standard.

2.3.9.4 Waste Rock Characterization and Handling

Section 3.4, Water Resources and Geochemistry, describes the proposed waste rock management plan submitted to BLM as part of the PoO (SRK 2009a). The location of PAG waste rock (material that could contribute to ARD and/or metal loading) would be identified during mining and managed according to the waste rock management plan.

Geochemical assessment of the waste rock for PAG properties would be a continuing process conducted in phases in order for data collection to be tailored to address issues specific to each stage of the mine life. Waste rock information and management measures would include:

- Characterization. Data have been and would continue to be collected for site-specific ARD and metal loading characteristics of the waste rock material. The ongoing testing program could include both static and kinetic testing.

- Prediction. Data would be analyzed to estimate the long-term behavior of mine waste considering climatic and other site-specific factors that may affect release and transport of acid and metals. Ongoing assessment of the ARD and metal loading risk based on available test results would be completed over the mine life to refine the long-term prediction models.
- Management. Waste rock characterized as PAG would be managed in accordance with the waste rock management plan described in Section 3.4, Water Resources and Geochemistry.
- Monitoring. Monitoring as outlined in the waste rock management plan submitted with the PoO (SRK 2009a) would be implemented throughout the mine life to compare monitoring results to predictions, and assess the success of prevention, containment, and treatment measures in order to modify mitigation options, as needed. The waste rock management plan would be updated periodically as information becomes available. Monitoring and assessment would be conducted during operations, and through the post-closure period.

2.3.9.5 Air Quality Protection Measures

Appropriate air quality permits would be obtained from the NDEP-Bureau of Air Pollution Control (BAPC) for the new proposed project facilities and surface disturbance. As required by BAPC regulations, the proposed project air quality operating permit would be authorized by the BAPC prior to proposed project construction.

Committed air quality practices would include dust control for mine unit operations as required by the air quality permits and BDMV's Fugitive Dust Control Plan submitted to BLM as part of the PoO. Dust control may include water application on haul roads and other disturbed areas; chemical dust suppressant application (such as magnesium chloride, calcium chloride, or lignin sulfate), where appropriate; and other dust control measures based on accepted and reasonable industry practice. Temporary disturbance areas (e.g., growth media stockpiles, etc.) would be seeded with an interim seed mix, and concurrent reclamation would be implemented on completed portions of the waste rock disposal facilities, thereby minimizing fugitive dust emissions.

BDMV would install air controls on stationary equipment used in the process. **Table 2-10** provides a summary of the locations and control devices expected for the proposed project.

Table 2-10 Summary of Air Control Equipment

Location	Activity	Control
Primary Crusher	Jaw crusher, conveyor	Baghouse
Secondary Crusher	Cone crusher, conveyor	Baghouse
Conveyor Transfer Points	Material transfer	Moisture content
Lime Silos	Loading	Baghouse

Source: SRK 2009a.

2.3.9.6 Erosion and Sediment Control

As described in Section 2.3.6.9, Storm Water Management Facilities, the SWPPP provides for BMPs to limit erosion and reduce sediment in precipitation runoff from proposed project facilities and disturbed areas during construction, operations, and closure. Revegetation of disturbed areas would reduce the potential for wind and water erosion. Following construction activities, areas such as growth media stockpiles would be seeded with the interim reclamation seed mix for stockpiles presented in **Appendix A**, **Table A-3** as soon as practical and safe. Concurrent reclamation would be maximized to the extent practical to accelerate revegetation of disturbed areas to reduce erosion potential.

2.3.9.7 Water Resource Protection

Process facilities would be designed, constructed, and operated in accordance with NDEP regulations, BLM 43 CFR 3809 regulations, and the BLM Cyanide Management Plan. The proposed heap leach pad facilities would be designed and operated as zero-discharge facilities, with a composite liner system in accordance with NDEP criteria.

BDMV would manage draindown fluid in a manner that protects water resources. As described in Section 2.3.3, Waste Rock Disposal Facilities, TD1 would be covered by 50 feet of waste rock as part of the construction of the West WRDF. TD1 draindown currently has diminished to a flow rate too low to be measured. As waste rock is placed over TD1 the draindown rate may temporarily increase. While waste rock is being placed, BDMV would monitor the draindown rate by recording the fluid level in the existing standpipe piezometer. If the fluid level were to rise to a level that risked overflow of the existing containment liner, stacking of waste would be halted, or the fluid would be removed to prevent overflow.

Surface water and groundwater monitoring would be conducted in accordance with monitoring plans prepared by BDMV to ensure compliance with permit criteria and to provide for early identification of potential impacts. If monitoring wells go dry, the monitoring program would be re-evaluated in coordination with the NDEP and BLM. BDMV submitted a site wide monitoring plan for the proposed project to the BLM as part of the PoO (SRK 2009a) as discussed in Section 2.3.9.15, Monitoring. The detailed water monitoring plan would be prepared prior to issuing the Final EIS and would be reviewed and updated annually to reflect changes in surface water and groundwater resources monitoring locations in the proposed project vicinity.

Mineral exploration and development drill holes, production wells, and monitoring wells would be closed in accordance with Nevada Revised Statute 534 when no longer in use to prevent contamination of groundwater resources.

2.3.9.8 Soils, Vegetation, and Weed Management

Suitable growth media would be identified and stockpiled during the development of the open pit for subsequent use in reclamation. As described in Section 2.3.8.4, Cover Material, selective salvage of the Carlin Formation would serve as the primary growth media cover material for the proposed project.

Following stripping, growth media for cover material would be stockpiled within the proposed disturbance areas or within the four areas designated for growth media stockpiles (**Figure 2-2**). Growth media stockpiles would be located such that mining operations would not disturb the stockpiles. The surfaces of the growth media stockpiles would be shaped after construction with slopes no steeper than 2.5H:1V to reduce erosion. To further minimize wind and water erosion, the growth media stockpiles would be seeded with an interim seed mix after shaping. The proposed interim seed mix is presented in **Appendix A**, **Table A-3**. Diversion channels and/or berms would be constructed around the stockpiles as needed to prevent erosion from overland runoff. BMPs, such as silt fences or staked straw bales, would be used as necessary to contain sediment liberated from direct precipitation. Alternately, the growth media may be transported to and redistributed on mine-related surface disturbance areas undergoing concurrent reclamation, such as WRDFs.

The introduction and spread of noxious weeds in proposed project-related disturbance areas would be minimized through the implementation of an approved Weed Management Plan. The plan integrates weed prevention and control techniques into a program that includes:

- Awareness and education;
- Prevention and detection;
- Inventory and record keeping;

- Integrated biological (e.g., introduction of weed control insects), chemical (e.g., herbicide use), cultural (e.g., grazing and pasture maintenance practices) and mechanical control (e.g., burning, mowing, cutting); and
- Monitoring and evaluation.

It is anticipated that the plan would be updated throughout the life of the proposed project and that noxious weed management would continue through the reclamation period of approximately 4 years while vegetation is being re-established. Weed management could continue longer depending on vegetation monitoring results. Any chemicals used for the weed management program would conform to applicable regulations.

Employees and contractors would be educated to identify noxious weeds that could occur in the proposed disturbance areas. BDMV would report occurrence of noxious weeds to the BLM and take appropriate measures to prevent the spread of noxious weeds. BMPs include the following:

- Seeding growth media stockpiles as soon as practical with an interim seed mix;
- Using certified weed-free hay and straw; and
- Using an approved certified weed-free seed mix to reduce invasive species over time by developing and maintaining desired plant communities.

2.3.9.9 Wildlife, Special Status Species, and Livestock Protection

The mine site would be surrounded by a BLM-approved 4-strand range fence, with 3-barb strands and a smooth bottom strand, to facilitate wildlife movement in the area (Section 2.3.6.8, Fencing). In accordance with NDOW specifications, an 8-foot-high wire mesh fence would be constructed around process ponds to minimize exposure of wildlife to process solutions.

The design of the proposed WRDFs has been refined to minimize disruption to mule deer migration (Section 2.4, Alternatives to the Proposed Action), through such methods as shape (paralleling rather than crosscutting valleys), final contouring of topography, and timing of waste rock placement and reclamation.

Netting, pond covers, or floating "bird balls," as appropriate, would be installed over ditches and ponds that would contain exposed process solutions to minimize potential impacts to volant (flying animals) and terrestrial wildlife species. In addition, the heap leach pads would be scarified to minimize ponding and pooling of process solutions.

To minimize raptor electrocutions and collision potential, power transmission lines would be designed and constructed in accordance with Avian Powerline Interaction Committee guidelines, including *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* and *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*.

To protect nesting birds, removal of migratory bird habitat on currently undisturbed lands in the project area would be avoided to the extent possible between March 1 and July 31 to comply with the Migratory Bird Treaty Act. Should removal of habitat be required during this period, BDMV would coordinate with the BLM and NDOW to conduct breeding bird surveys and implement appropriate mitigation, such as buffer zones around occupied nests, as needed.

In the event that initiation of the proposed project should occur during the raptor nesting season (March 1 through July 31), a raptor survey would be conducted, and appropriate mitigation measures, such as buffer zones around occupied nests, would be developed and implemented, as needed.

To minimize wildlife/vehicle-related collision impacts during project operations, BDMV would require a mandatory employee education program for all personnel.

Implementation of BDMV's closure plan would minimize long-term habitat impacts for wildlife resources through the re-establishment of forage habitat.

2.3.9.10 Cattle Movement and Access to Water

The proposed project is located within the Twenty Five Grazing Allotment (Section 3.16, Range Resources). BDMV would assure livestock activities could safely continue during construction and operation of the proposed project. BDMV would implement cattle movement measures during the construction phase of the project and maintain them during the operations phase. The final closure plan developed within 2 years of the close of the proposed project would be coordinated with the permittee and BLM and would address the final disposition of facilities associated with the measures in the long-term. BDMV would commit to the following measures that were developed through discussions with the Twenty Five Grazing Allotment permittee and the BLM:

- Preventing Cattle Movement Into Proposed Project Areas. BDMV would establish cattleguards and associated fencing as shown in **Figure 2-2** to prevent cattle from wandering into PoO area or roads. A proposed southern cattleguard and associated fence would be installed across the Boulder Valley Road approximately 2 miles south of the primary access to the site. The southern cattleguard and fence would tie into the proposed project fence and existing allotment fence in a manner that would prevent cattle in southern pastures from wandering north onto the road or into mining areas.

  On the northern end of the PoO boundary, an existing cattleguard located approximately 1 mile north of the primary access to the site across the Boulder Valley Road would be augmented with new fence that would tie into the proposed project fence and existing allotment fence. The northern cattleguard and fence system would be installed to prevent cattle in southern pastures from wandering south onto the road or into mining areas.
- Facilitating Cattle Movement During Spring and Autumn Cattle Drives. BDMV would provide measures for cattle to be safely moved between the north and south pastures twice per year. The specifics of the measures would be worked out with the Twenty Five Grazing Allotment permittee and the BLM prior to the seasonal drives that normally take place over a period of 3 to 4 days. The measures to facilitate movement could include (but would not be limited to) building temporary barriers across the Bootstrap Haul Road to keep cattle in the driveway, temporary blocks across the primary access to the site, and addition of permanent fencing along the driveway that generally parallels the Boulder Valley Road. Temporary barriers could include temporary gates, fencing, and wood slats.
- Water Supply During Cattle Drives. BDMV would provide water for cattle management at two locations during cattle movement. BDMV may choose to supply the water by drilling a well, by conveying water from the proposed project area by a pipeline, or by trucking water to a tank. **Figure 2-2** shows the cattle water supply locations as a proposed well. One water supply location would be east of the proposed East WRDF and one is located south of the proposed project area near the Bell Creek substation. In the case where a well is drilled to supply the water, BDMV would supply a pump and electrical connection point for a generator (to be supplied by the grazing permittee).

2.3.9.11 Site Safety and Fire Protection

The proposed project would operate in conformance with MSHA safety regulations (30 CFR 1-199). BDMV would comply with applicable federal and state fire laws and regulations and would take reasonable measures to prevent and suppress fires in the area of operations.

2.3.9.12 Geology

The mine design includes evaluation and consideration of the potential for both kinematic and mass failures under static and seismic conditions and the consequences of such failures. Geotechnical monitoring consisting of geologic structure mapping, groundwater monitoring, and slope stability analyses would be conducted during active mining to assist in optimizing final pit designs. Slope movement monitoring during operations and during the reclamation period would be implemented to evaluate the safety of the open-pit highwalls. In addition, operational procedures for controlling blasting would contribute to stable pit walls during mining operations.

2.3.9.13 Visual Resources

The proposed project facilities have been designed to facilitate closure and reclamation at the cessation of operations. As described in Section 2.3.8, Closure and Reclamation Plan, post-mining land use and reclamation goals include constructing stable land forms that blend with existing topography. Reclamation completed concurrently with operations would contribute to limiting impact to visual resources.

2.3.9.14 Employee Awareness and Education Program

BDMV would train employees, contractors, and other personnel as required by permits and regulations governing the proposed project to develop awareness and understanding of environmental and cultural obligations. An employee training plan would be maintained by BDMV to ensure training obligations would be met during construction, operation, and closure phases of the proposed project to limit impacts to environmental and cultural resources.

2.3.9.15 Monitoring

BDMV submitted a site-wide monitoring plan for the proposed project to the BLM as part of the PoO (SRK 2009a). The site-wide monitoring plan establishes that BDMV would monitor components of the Proposed Action in conformance with federal and state requirements. **Table 2-11** summarizes the proposed site-wide monitoring plans. Specific details of monitoring plans would be available as the permitting process for the Proposed Action is completed (prior to issuance of the Final EIS and would be included in the Final EIS). Monitoring plans for environmental protection measures would identify the responsible party for monitoring, monitoring schedule, criteria for measuring effectiveness, and a plan for adaptive management if the measure is not achieving the expected level of effectiveness.

2.4 Alternatives to the Proposed Action

As required by the BLM NEPA Handbook (H-1790-1), a range of alternatives was identified and considered, including the No Action Alternative. The No Action Alternative reflects a continuation of current management practices. Alternatives, other than the No Action Alternative, represent other means of satisfying the identified purpose and need, and resolving issues raised during the scoping process.

Each potential alternative was considered and evaluated based on its ability to satisfy the project purpose and need, potential environmental benefit over the Proposed Action, and technical and economic feasibility. This section describes the alternatives and the rationale for considering them in detail or eliminating them from further analysis.

During the scoping process, a number of issues were raised concerning the original design of the proposed West WRDF presented in the PoO submitted to the BLM (SRK 2009a). The original proposed West WRDF design would have buried the existing Dee heap leach pads and TD1 under hundreds of feet of waste rock. Additionally, the original proposed West WRDF extended to the north in a manner that would potentially interfere with mule deer migration. In response to these concerns, BDMV revised the West WRDF design.

Table 2-11 Summary of Proposed Monitoring Plans

Monitoring Component/Permit	General Sampling/ Monitoring Parameters	Monitoring/ Sampling Frequency	Reporting Agency/ Reporting Frequency
Air Quality Air Quality Operating Permit	Actual Emissions Production Reporting Form	Annually	NDEP-BAPC annually
Groundwater and Surface Water Water Pollution Control Permit	NDEP Profile I, elevation	Quarterly	NDEP-BMRR, BLM quarterly
Heap Leach Pad Effluent Chemistry Water Pollution Control Permit	NDEP Profile I	Quarterly	NDEP-BMRR, BLM quarterly and annually
Noxious Weeds PoO	Visual Inspection	Annually	BLM as infestations identified
Waste Rock Chemistry Water Pollution Control Permit	ABA and MWMP	Quarterly	NDEP-Bureau of Water Pollution Control, BLM quarterly and annually
Reclamation	Visual or survey of revegetation success, erosion controls	Annually	NDEP-BMRR, BLM quarterly and annually
Slope Stability (open pit, WRDFs, heap leach pad	Visual Inspection	Daily	MSHA (slope failures); NDEP and BLM (erosion control failures) as failures identified
Storm Water Controls	Visual Inspection	After major rain or snowmelt events, at least annually	NDEP-Bureau of Water Pollution Control and BLM annually
Wildlife	Visual Inspection, Mortality	Daily	NDOW quarterly

Source: SRK 2009a.

Table 2-12 summarizes the primary issues raised during scoping and the design change made in the original proposed project to address the issue. The design changes described in **Table 2-12** have been incorporated into the Proposed Action.

This section provides a discussion of the No Action Alternative and alternatives to the Proposed Action considered in detail. These action alternatives potentially satisfy the identified purpose and need, produce environmental benefit, and retain economic and technical feasibility.

A discussion of alternatives eliminated from detailed analysis is provided in Section 2.4.4, Alternatives Considered but Eliminated from Detailed Analysis.

Table 2-12 Design Changes to Proposed Action to Address Arturo Mine Project Scoping Issues

Scoping Issue	Design Change
Potential impacts to the Mule Deer migration corridor on the north side of the original proposed West WRDF.	The West WRDF was redesigned to minimize impact to the Mule Deer migration corridor by scaling back the north side. The west side of the West WRDF was expanded and increased in height within the original project boundary to fully accommodate the volume of waste rock required.
Potential long-term stability and fluid management concerns due to original proposed West WRDF design to bury existing reclaimed TD1 facility.	The West WRDF was redesigned to avoid deep burial of the existing TD1 facility, as described in Section 2.4.1.1, Single WRDF Alternative Scenario – Deep Waste Rock Cover Placement Over TD1 Site.
Potential long-term liner integrity issues associated with the existing reclaimed heap leach pads that would have been buried in place by the West WRDF in the original design.	The Proposed Action was modified to include removal of the existing reclaimed Heap Leach Pads No. 1-9, No. 10, and No. 11 prior to placement of waste rock in the West WRDF, as described in Section 2.3.4.3, Heap Leach Pad Facility. The leach material in the existing heap leach pad facilities would be placed on the proposed Heap Leach Pad No. 12 for further processing.

2.4.1 Single WRDF Alternative

Under this alternative, the East WRDF would be eliminated, and the size of the West WRDF would be increased to accommodate all of the waste rock for the proposed project. Under the Single WRDF Alternative, all waste rock from the Proposed Action would be hauled by truck to the West WRDF. The East WRDF described in the Proposed Action would not be built and the associated area would remain undisturbed. The proposed on-site Nevada Class III waivered landfill described in Section 2.3.6.7, Chemical Fuel, and Hazardous Materials Storage, would be relocated to the West WRDF as shown in **Figure 2-13**. The design and construction of all other facilities described in Section 2.3, Proposed Action, would remain the same, including the open pit; Heap Leach Pad No. 12; ore and growth media stockpiles; ore processing facilities; Bootstrap Haul Road; office/shop complex; and other ancillary facility areas.

Two scenarios were considered for this alternative. The scenarios differ by the depth of waste rock placed on the West WRDF over the area of TD1. The existing reclaimed TD1 facility is located within the footprint of the proposed West WRDF. TD1 was designed to contain tailings deposited as mill slurry during the operation of the Dee Gold Mine. Tailings are the ground rock remaining after milling and processing has removed metals from the ore. The TD1 tailings has a high residual moisture content (typical of slurried mill tailings) that has been draining over time. The existing TD1 ET cell currently manages draindown from the facility as described in Section 2.2.3, Existing Facilities.

The following sections describe the two scenarios considered for this alternative. The deep cover scenario was eliminated from detailed consideration. The scenario with shallow depth of cover over TD1 was analyzed in detail in this EIS.

2.4.1.1 Single WRDF Alternative Scenario – Deep Waste Rock Cover Placement Over TD1 Site

Placement of additional waste rock on the West WRDF in the area overlaying the existing TD1 facility was considered as a way to increase the WRDF capacity to allow the Single WRDF Alternative. Under this scenario, the West WRDF would have a more symmetrical final form because the low area created by limiting the cover over TD1 to 50 feet in depth as proposed for the Proposed Action would be eliminated. Allowing the full cover over the TD1 site would be accomplished by either: 1) relocating the TD1 tailings to another area located outside the footprint of the Single WRDF; or 2) covering TD1 in place with several hundred feet of waste rock. The more symmetrical form of the WRDF resulting from this scenario was considered as a possible benefit to wildlife, addressing a concern that mule deer might be trapped in snow accumulating in the topographic low area created on the final form of the West WRDF under the Proposed Action.

As this scenario was considered, it was determined that the saturated tailings stored in TD1 would be too fluid for effective excavation and relocation via shovel and truck methods. Other relocation methods (e.g., slurrying) would introduce excess water into an unlined facility, increasing the potential for mobilization of constituents in the tailings and tailings solution. After removal, saturated or slurried tailings would need to be managed in an additional facility designed and constructed for that purpose. Relocation of the TD1 tailings to another area was determined to not be feasible.

Under the scenario that TD1 would be left in place and covered to form a more symmetrical final West WRDF configuration, TD1 would be covered with a depth of up to 340 feet of waste rock material. Geotechnical stability and water quality concerns are associated with covering of TD1 in place with hundreds of feet of waste rock. As described above, the tailings stored in TD1 are primarily saturated and unconsolidated fine-grained material. Full cover burial of TD1 could result in failure of the facility and associated fluid collection system. Burial of TD1 with several hundred feet of cover could increase the seepage rate of the tailings solution beyond the capacity of the existing ET cell with potential adverse effects on long-term groundwater or surface water quality. Deep burial of TD1 would make it difficult or impossible to fully inspect, capture, control, and treat tailings solution released during consolidation of the waste rock and tailings material. Settlement of the waste rock facility could alter surface drainage patterns or result in unintended surface ponding on the facility after closure. The Proposed Action plan to limit cover on TD1 to 50 feet limits these risks.

The interaction of wildlife, snow accumulation and the topographic form of the West WRDF proposed for the Proposed Action was considered under this scenario as a potential reason to eliminate the low area in the West WRDF final form in the Proposed Action. The low area created by limiting the waste rock cover over TD1 to 50 feet in depth occurs at an elevation below 6,000 feet amsl. Preliminary analysis indicated deep snow accumulation would not be a concern for wildlife at this elevation in the PoO area. The preliminary analysis showed deer should be able to navigate within the low area and the deer would be capable of moving from the area under most conditions (Great Basin Ecology 2011).

The scenario for full depth of waste rock cover over the TD1 Site for the Single Waste Rock Alternative (either by relocation of TD1 or increasing depth of cover over TD1) was eliminated from further consideration for the following reasons:

- Preliminary analysis showed that the final configuration of the West WRDF with a low area over the 50-foot cover over TD1 as described in the Proposed Action would not result in adverse impacts to wildlife due to snow accumulation.
- It is not feasible or practical to relocate the saturated TD1 tailings without increasing the potential to mobilize tailings and fluids.
- TD1 has poor geotechnical properties for burial under more than 50 feet of waste rock. Deeper burial of TD1 would have the potential to decrease the geotechnical stability of the tailings

embankment. Pressure resulting from full burial could result in an uncontrolled release of tailings solution in the subsurface that could negatively impact downgradient water quality.

- Deep burial of the facility would have the potential to damage, or make it difficult or impossible to maintain, the existing tailings fluid management system including TD1 ET Cell. Failure or damage of the fluid management system could negatively impact downgradient water quality.
- Settlement of the tailings could result in alteration of the surface drainage patterns on the final reclaimed surface of the waste rock facility.

2.4.1.2 Single WRDF Alternative Scenario – Shallow Waste Rock Cover Placement Over TD1 Site

Under this scenario of the Single WRDF Alternative, the depth of cover over the existing TD1 would be limited to 50 feet as in the Proposed Action. Additionally, the configuration of the proposed West WRDF design would be modified to accommodate the full 600 MT of waste rock produced by the proposed project. The footprint of the West WRDF would be expanded approximately 30 feet to the west in some areas and would extend further to the north by approximately 500 feet compared to the proposed project. Additionally, the height of the West WRDF would be increased by approximately 40 feet compared to the proposed project under this scenario while retaining the low area in the final topography caused by limiting cover depth to 50 feet over the TD1 site.

This single WRDF alternative scenario is considered in detail in the following sections. **Table 2-13** summarizes capacity and dimensions of the West WRDF under this alternative. A plan view of the site with the Single WRDF Alternative is shown in **Figure 2-13**.

Table 2-13 Single WRDF Alternative Waste Rock Disposal Facility Capacity and Height[1]

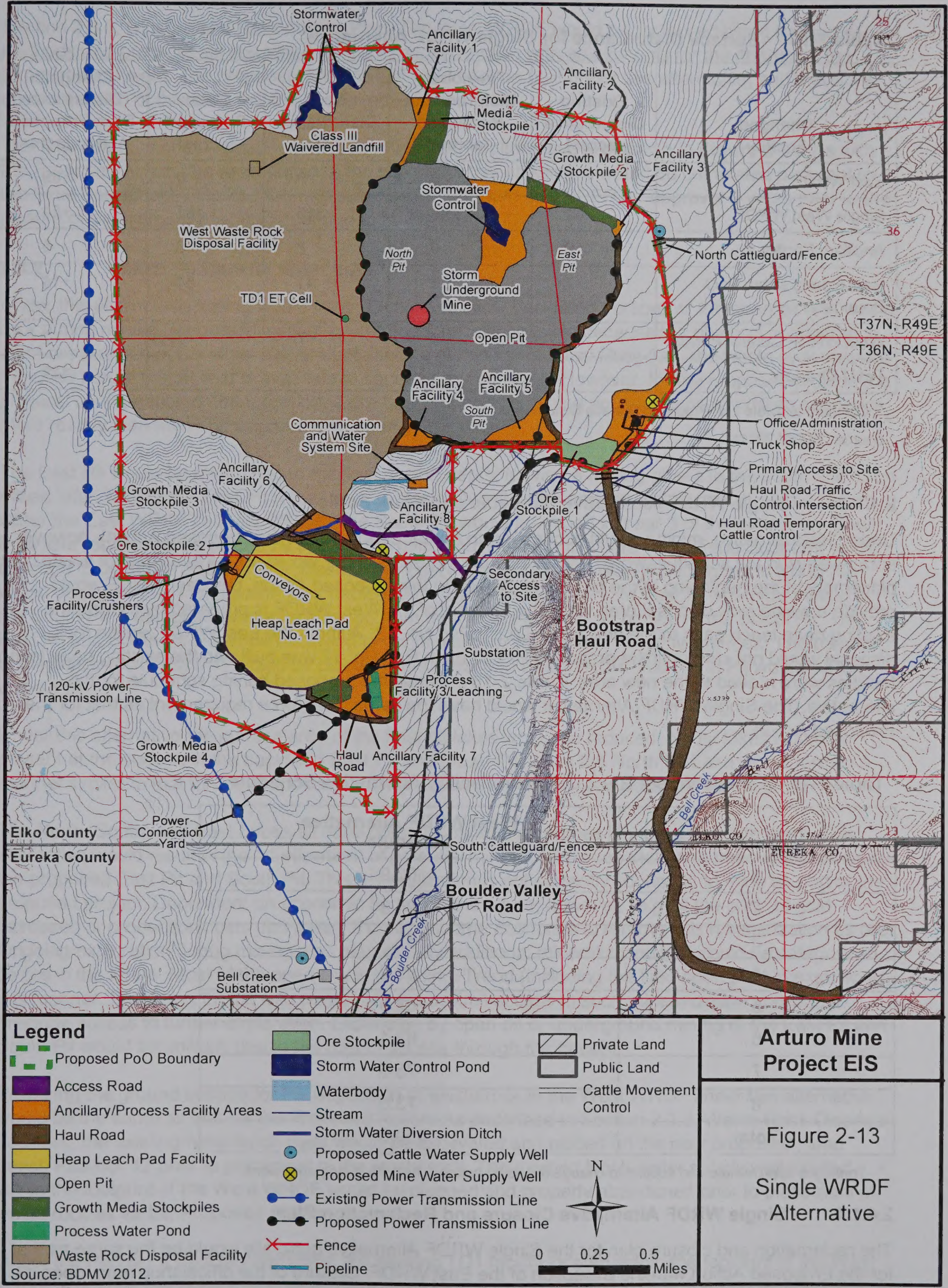
Location	Capacity (MT)	Height (feet ags)	Crest Elevation (feet amsl)	Footprint (acres)
Single West WRDF	600 MT	655	6,130	1,161

[1] The amount of PAG material placed in the WRDF would be determined in accordance with the waste rock management plan.

Source: BDMV 2011a.

Under this scenario for the Single WRDF Alternative, the existing TD1 facility located within the footprint of the West WRDF would be managed in the same manner as for the Proposed Action. As described in Section 2.3.3, Waste Rock Disposal Facilities, waste rock initially would be placed in a manner to buttress TD1 to enhance stability. TD1 then would be covered with no more than 50 feet of waste rock material in order to limit pressure on TD1 and allow recontouring in a manner that manages long-term surface water and infiltration. As in the Proposed Action, the existing TD1 ET Cell would be retained during operations and in final closure to manage seepage water draining from TD1. As with the Proposed Action, a local low area in the final topography would be present where the West WRDF was built over TD1 and around the TD1 ET Cell area. Storm water from the area would flow toward the east where it would be directed away from the open pit by berms, as in the Proposed Action.

This alternative reduces the total area of disturbance compared to the Proposed Action by eliminating the proposed East WRDF and reducing the size of supporting areas. This decrease is partially offset by an increase in the footprint of the West WRDF necessary to accommodate the total volume of waste rock. All other components of the proposed project remain the same as in the Proposed Action. Overall, the total disturbance for the Single WRDF Alternative would be 2,646 acres, 128 acres less than that for the Proposed Action. Changes in surface disturbance for the Single WRDF Alternative are summarized in **Table 2-14**. All of the changes take place on public land.


Stormwater Control
Ancillary Facility 1
Ancillary Facility 2
Growth Media Stockpile 1
Class III Waivered Landfill
Growth Media Stockpile 2
Ancillary Facility 3
Stormwater Control
West Waste Rock Disposal Facility
North Pit
East Pit
North Cattleguard/Fence
Storm Underground Mine
TD1 ET Cell
Open Pit
T37N, R49E
T36N, R49E
Ancillary Facility 4
Ancillary Facility 5
South Pit
Office/Administration
Truck Shop
Primary Access to Site
Haul Road Traffic Control Intersection
Haul Road Temporary Cattle Control
Communication and Water System Site
Ancillary Facility 6
Growth Media Stockpile 3
Ancillary Facility 8
Ore Stockpile 1
Ore Stockpile 2
Conveyors
Secondary Access to Site
Process Facility/Crushers
Heap Leach Pad No. 12
Bootstrap Haul Road
Substation
Process Facility 3/Leaching
120-kV Power Transmission Line
Growth Media Stockpile 4
Haul Road
Ancillary Facility 7
Power Connection Yard
Elko County
Eureka County
South Cattleguard/Fence
Boulder Valley Road
Boulder Creek
Bell Creek
Bell Creek Substation
25
36
11
12
13
Legend
Proposed PoO Boundary
Access Road
Ancillary/Process Facility Areas
Haul Road
Heap Leach Pad Facility
Open Pit
Growth Media Stockpiles
Process Water Pond
Waste Rock Disposal Facility
Source: BDMV 2012.
Ore Stockpile
Storm Water Control Pond
Waterbody
Stream
Storm Water Diversion Ditch
Proposed Cattle Water Supply Well
Proposed Mine Water Supply Well
Existing Power Transmission Line
Proposed Power Transmission Line
Fence
Pipeline
Private Land
Public Land
Cattle Movement Control
N
0 0.25 0.5 Miles
Arturo Mine Project EIS
Figure 2-13
Single WRDF Alternative

05/20/2012

Table 2-14 Surface Disturbance for Single WRDF Alternative[1]

Changed Facility	Existing Disturbance (acres)	Previously Disturbed but Reclaimed (acres)	New Disturbance (acres)	Total Proposed (acres)	Change in Disturbance from Proposed Action (acres)
East WRDF	0	0	0	0	-189
Single West WRDF	61	285	815	1,161	+54
Ancillary Facility 1	0	0	8	8	-5
Haul Roads within PoO Boundary	7	16	41	64	+14
West WRDF Control Ponds	0	0	7	7	-2
Total Change					**-128**

[1] Compare to **Table 2-2**, Proposed Surface Disturbance.

Source: BDMV 2011a.

2.4.1.3 Single WRDF Alternative Schedule and Work Force

Under this alternative, mining would occur over an 8-year period (as for the Proposed Action), however, some delays in the schedule would occur because the East WRDF would not be available for waste rock placement at the beginning of the proposed project. In the Proposed Action, the East WRDF would provide a waste rock disposal area while the footprint of the West WRDF is prepared by moving the existing heap leach pads to the new Heap Leach Pad No. 12. Without the East WRDF, waste rock disposal would not start until the proposed Heap Leach Pad No. 12 was built and the existing heap leach facilities were moved to the new area. **Table 2-15** provides the proposed mining schedule for this alternative. The Single WRDF Alternative would have the same work force requirement as that for the Proposed Action.

Table 2-15 Single Waste Rock Disposal Facility Alternative Schedule

Year	West WRDF Alternative Schedule
1	60.9
2	94.8
3	85.1
4	85.2
5	62.3
6	63.1
7	75.6
8	73.0
Total	**600.0**

[1] Tonnages approximate and subject to change based on actual conditions during operations.

2.4.1.4 Single WRDF Alternative Closure and Reclamation Plan

The reclamation and closure plan for the Single WRDF Alternative generally would be the same as that for the Proposed Action with the exception of the East WRDF. Closure of the office/shop area, open pit, heap leach pad and other facilities not affected by this alternative would be the same as described in

Section 2.3.8, Closure and Reclamation Plan. The West WRDF would be reclaimed using the same methods and practices as described for the Proposed Action with adjustments for the change in the footprint and height. The proposed East WRDF would not be built under this alternative, and therefore, no reclamation of this area would be required.

The final contours of the reclaimed mine facilities for this alternative are shown in **Figure 2-14**. As with the Proposed Action, the reclamation of the site under this alternative would be completed pursuant to the Final Permanent Closure Plan and submitted to the BLM and NDEP for approval 2 years prior to the closure of each process facility according to NAC 445A.447.

2.4.2 Partial Pit Backfill Alternative

Under this alternative, mining would be sequenced to allow backfilling portions of the open pit with waste rock during mining. Pit backfilling is often not economically possible because the physical configuration of an ore body does not allow efficient sequencing of mining and backfilling (i.e., the waste rock must be removed before the pit void is available to serve as a repository). However, for the proposed project, the physical configuration of the three-lobed ore body supports a mining and partial pit backfilling sequence more readily than many typical hard rock open pit mines.

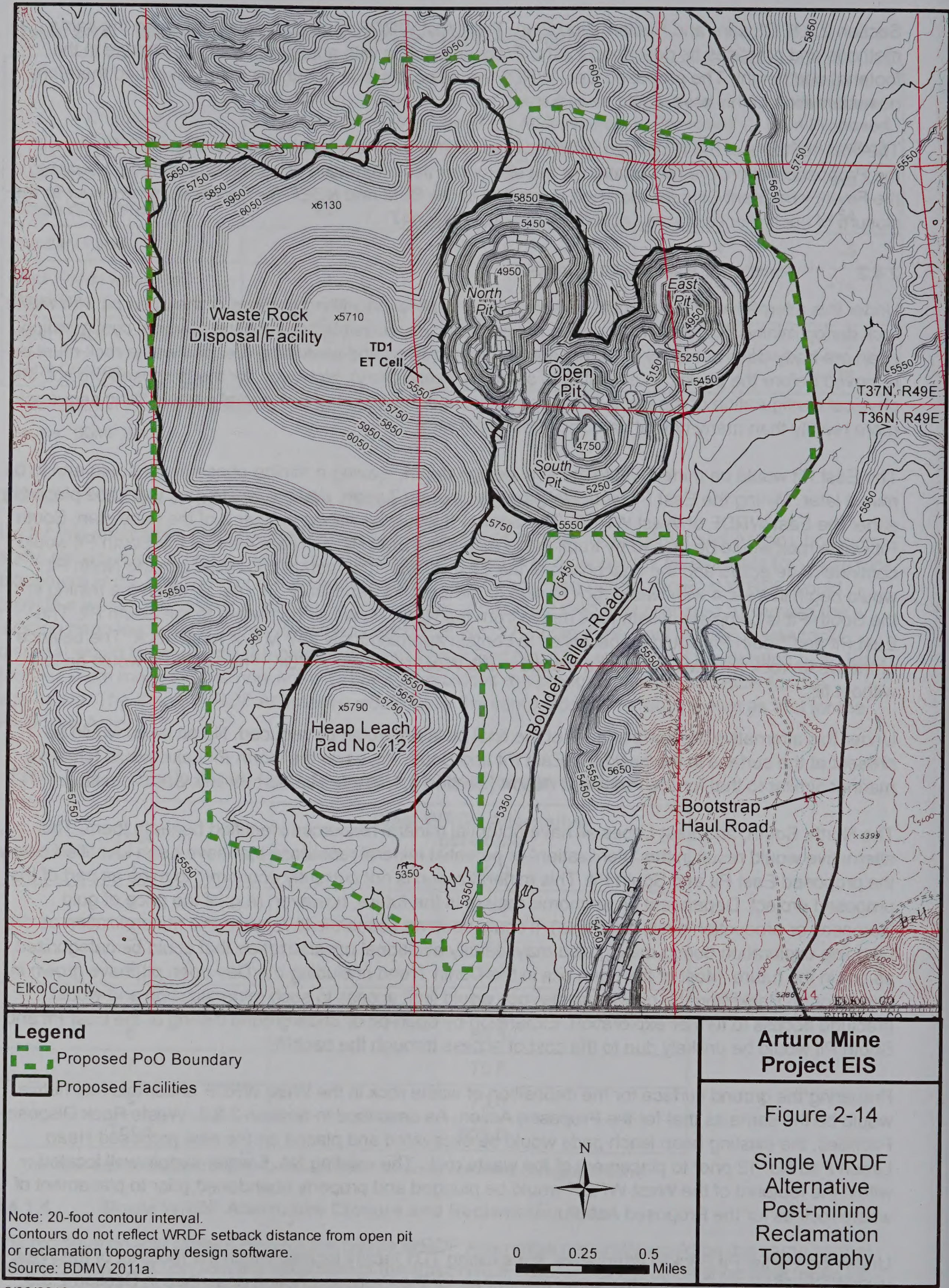
The East Pit would be mined first to the final design depth, leaving a mining phase in the south end to be mined later. Mining the East Pit would take approximately 2 years and the waste rock would be placed in either the East WRDF or West WRDF. The South Pit would be mined in Year 3 of the mine plan. South Pit waste rock would be placed by truck in the mined out East Pit. In Years 4 and 5 the South Pit would continue to be active and the final phase of the East Pit would be completed. Mining in the North Pit would begin in Year 4 with waste rock hauled to the East Pit depository. In Year 6, when the mining in the South Pit is complete, waste rock mined from the North Pit would be hauled to the South Pit. The East Pit and South Pit would be backfilled to contain approximately 247 MT of waste rock. The balance of the waste rock (353 MT) would be placed in the West and East WRDF. The North Pit would be left without fill.

Under this alternative the surface area of the final pit lakes would be reduced. No pit lakes would be present at the surface in the backfilled East Pit and South Pit, while the North Pit Lake would form in a manner similar to that for the Proposed Action (Section 3.4, Water Resources and Geochemistry).

The North, South, and East Lobes all have potential mineral resources identified beneath them. This alternative would result in the "sterilization" of potential mineral resources that have been identified below the proposed East Pit and South Pit. This mineralization is not currently economic to mine as part of the proposed project. Dependent on economic factors in the future, however, (e.g., if the price of gold increases or production costs decrease), it could become economic to remove this mineralization as ore. Ongoing exploration during mining also may identify additional mineralization that could be categorized as ore in the future. Most of the open pits in the Carlin Trend (including the Dee open pit) have grown in this manner. Backfilling the pit with waste rock would limit access to such mineralization and would preclude access to further exploration. Expansion by open-pit or underground mining of the East Pit and South Pit would be unlikely due to the cost of access through the backfill.

Preparing the ground surface for the deposition of waste rock in the West WRDF under this alternative would be the same as that for the Proposed Action. As described in Section 2.3.3, Waste Rock Disposal Facilities, the existing heap leach pads would be excavated and placed on the new proposed Heap Leach Pad No. 12 prior to placement of the waste rock. The existing No. 5 water supply well located within the footprint of the West WRDF would be plugged and properly abandoned prior to placement of waste rock as for the Proposed Action.

Under the Partial Pit Backfill Alternative, the existing TD1 facility located within the footprint of the West WRDF would be managed in the same manner as for the Proposed Action described in Section 2.3.3, Waste Rock Disposal Facilities. As with the Proposed Action, no more than 50 feet of waste rock would



Note: 20-foot contour interval.
Contours do not reflect WRDF setback distance from open pit or reclamation topography design software.
Source: BDMV 2011a.

Arturo Mine Project EIS

Figure 2-14

Single WRDF Alternative Post-mining Reclamation Topography

5/22/2012

be placed on the existing TD1 facility and TD1 ET cell would be retained to manage long-term draindown of TD1. The final form of the West WRDF would include the topographic low over the TD1 area as described for the Proposed Action.

Figures 2-2 and **2-3** show the surface facilities and footprint for the Partial Pit Backfill Alternative as they are identical to those for the Proposed Action. The disturbed surface acres for this alternative are the same as for the Proposed Action and can be found in **Tables 2-2** and **2-3**.

While the footprint of the surface facilities are the same for this alternative compared to the Proposed Action, design height and capacity of the West and East WRDF is significantly different due to the distribution of the waste rock into the East Pit and South Pit. Compared to the Proposed Action, the West WRDF would be 230 feet lower and the East WRDF would be 310 feet higher under the Partial Pit Backfill Alternative. Keeping the West WRDF footprint the same as that for the Proposed Action allows for the decrease in height, which allows for more efficient haul truck fuel usage on the West WRDF construction. **Table 2-16** provides additional information on the disposal of waste rock for the Partial Pit Backfill Alternative. Cross sections through the open pit, West WRDF and the East WRDF are provided in **Figures 2-15**, **2-16**, and **2-17**. The East WRDF would grade into the waste rock deposited in the pit as shown in the final contours for the alternative in **Figure 2-18**.

Table 2-16 Partial Pit Backfill Alternative Waste Rock Disposal Facility Capacity and Height[1]

Location	Capacity (MT)	Height (feet ags)	Crest Elevation (feet amsl)	Footprint (acres)
West WRDF	278	385	5,860	1,107
East WRDF	75	520	5,960	189
In-pit Backfill	247	520	5,960	291

[1] The amount of PAG material placed in each facility would be determined in accordance with the Waste Rock Management Plan.

Source: BDMV 2011a.

2.4.2.1 Partial Pit Backfill Alternative Schedule and Work Force

Under this alternative, delays in the schedule would occur to adjust for transport of the waste rock to the East and South Pit. The mining rate would slow overall by an estimated 22 percent resulting in a 1-year extension of the mine life. Due to the slower mining rate, this alternative would use nine fewer trucks and one less electrical shovel compared with the Proposed Action. The highest employee count at the peak of mining operations would be 290 workers (compared with 380 workers for the Proposed Action) and fewer employees per annum would be employed under this alternative.

Table 2-17 provides the proposed mining schedule for this alternative.

Table 2-17 Partial Pit Backfill Alternative Mining Schedule[1]

Year	Total Waste Rock (MT)	East WRDF (MT)	West WRDF (MT)	Partial Pit WRDF (MT)
1	41	41		
2	53	6	47	
3	96	28	9	59
4	97		97	

Table 2-17 Partial Pit Backfill Alternative Mining Schedule[1]

Year	Total Waste Rock (MT)	East WRDF (MT)	West WRDF (MT)	Partial Pit WRDF (MT)
5	88		88	
6	82			82
7	80		37	43
8	48			48
9	15			15
Total	600	75	278	247

[1] Tonnages approximate and subject to change based on actual conditions during operations.

Source: BDMV 2011a.

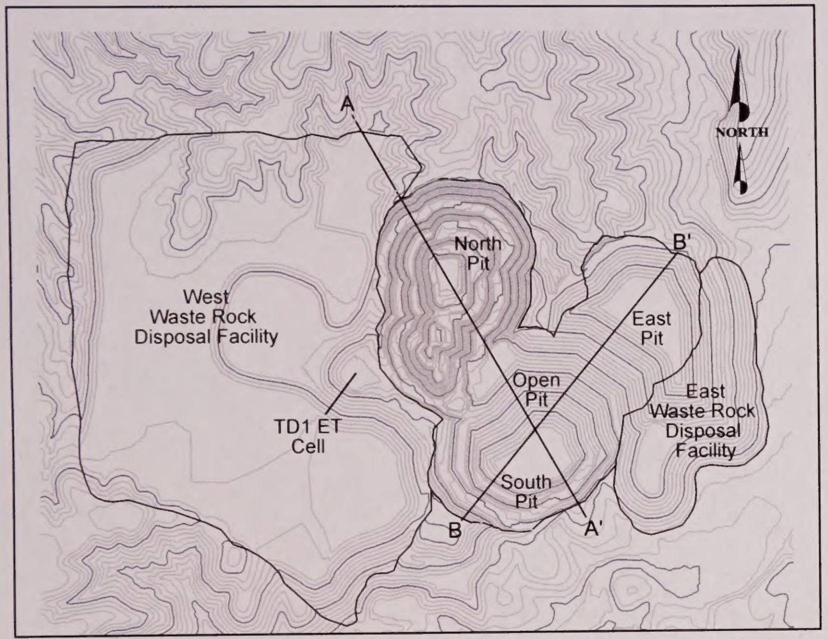
2.4.2.2 Partial Pit Backfill Alternative Closure and Reclamation Plan

The reclamation and closure plan of the Partial Pit Backfill Alternative generally would be the same as that for the Proposed Action. Closure of the office/shop area, heap leach pad and other facilities not affected by the change in the waste rock disposal facilities would be the same as described in Section 2.3.8, Closure and Reclamation Plan. The West WRDF would be reclaimed using the same methods and practices described for the Proposed Action with adjustments for the change in height.

The final form of the proposed East WRDF would grade into the East and South Pit backfill as shown in the final contours in **Figure 2-18**. From the topographic mounded area created by the East WRDF and the East Pit backfill, a 3H:1V slope would grade to the low area created by the South Pit Backfill. The East WRDF, East Pit backfill and South Pit backfill area would be reclaimed in the same manner as WRDFs in the Proposed Action (regraded, 24 inches of growth media cover, and revegetated). The in-pit backfill in the South Pit would not cover the highest pit walls on the south side of the South Pit. As with the Proposed Action, the southern pit would not be regraded or reclaimed and the mining benches would locally fail inward toward the reclaimed low area of the South Pit. Over time, a stable landform would form and vegetation would naturally become established (volunteer) on the South Pit walls and any wall material that would be deposited in the South Pit backfilled area from the pit wall failure. The North Pit would not be backfilled and would be left un-reclaimed in a manner identical to the open pit described in the Proposed Action. Overall, the Partial Pit Backfill Alternative increases the total reclaimed acres by 291 acres due to the portion of the open pit that would be backfilled, regraded, covered, and revegetated.

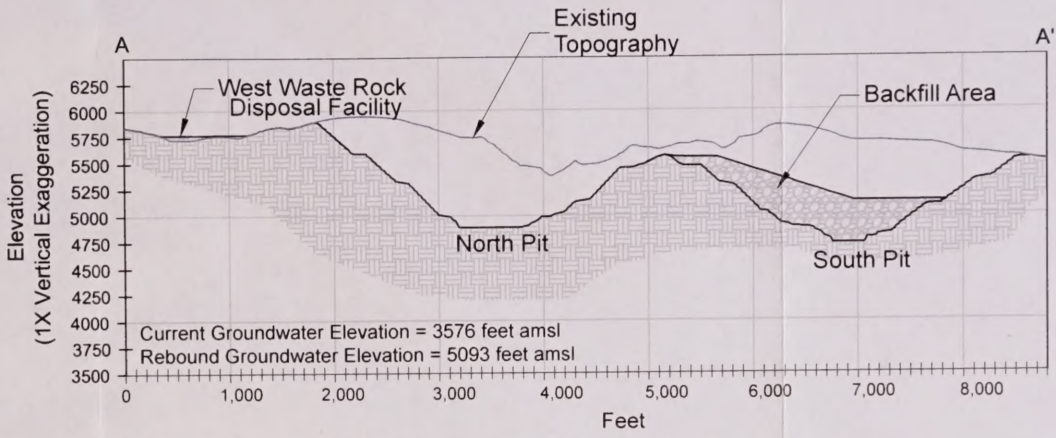
As with the Proposed Action, post-mining safety barriers, such as berms, fencing, or other appropriate barriers would be installed as necessary to eliminate access by people, livestock, and wildlife. A 4-foot-high pit perimeter berm would be constructed around the perimeter of the open pit to prevent access to the predicted pit wall failure zone.

The final contours of the reclaimed mine facilities for this alternative are shown in **Figure 2-18**. As with the Proposed Action, the reclamation of the site under this alternative would be completed pursuant to the Final Permanent Closure Plan and submitted to the BLM and NDEP for approval 2 years prior to the closure of each process facility according to NAC 445A.447.

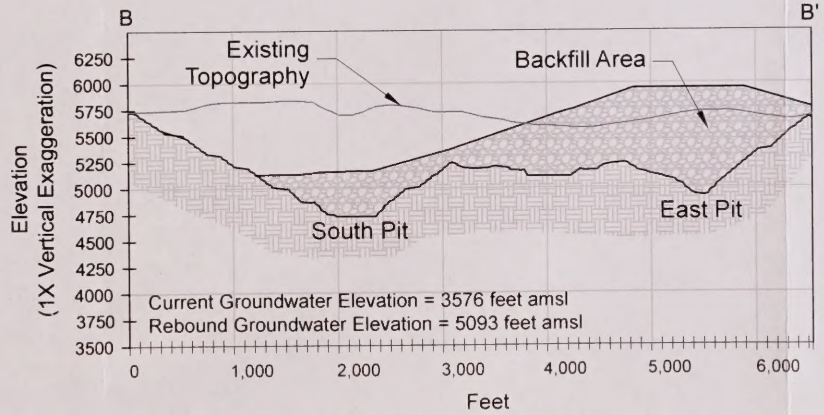

A
NORTH
North Pit
B'
West Waste Rock Disposal Facility
East Pit
Open Pit
TD1 ET Cell
East Waste Rock Disposal Facility
South Pit
B
A'

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet


A
A'
Existing Topography
West Waste Rock Disposal Facility
Backfill Area
North Pit
South Pit
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
4250
4000
3750
3500
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Feet

Profile View of A - A'
Scale: 1 inch = 1,500 feet



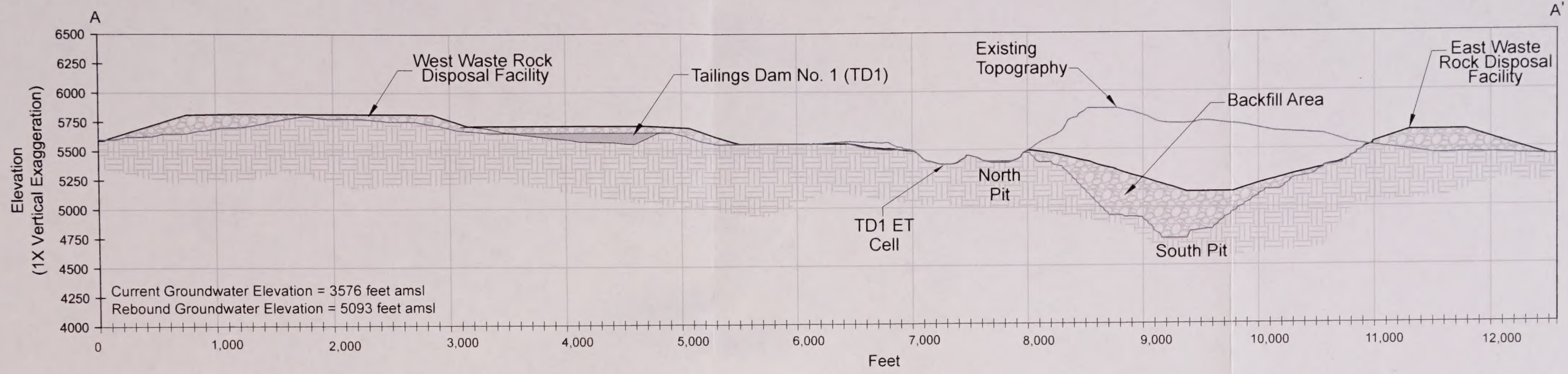
Profile View of B - B'
Scale: 1 inch = 1,500 feet

Arturo Mine Project EIS

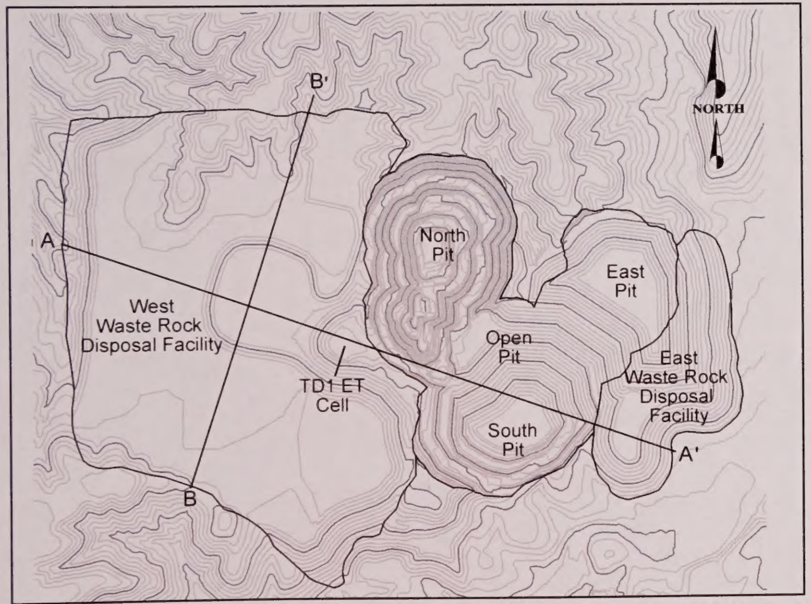
Figure 2-15

Partial Pit Backfill Alternative Typical Cross-sections of Open Pit with Reclaimed Slopes

Source: BDMV 2011a.

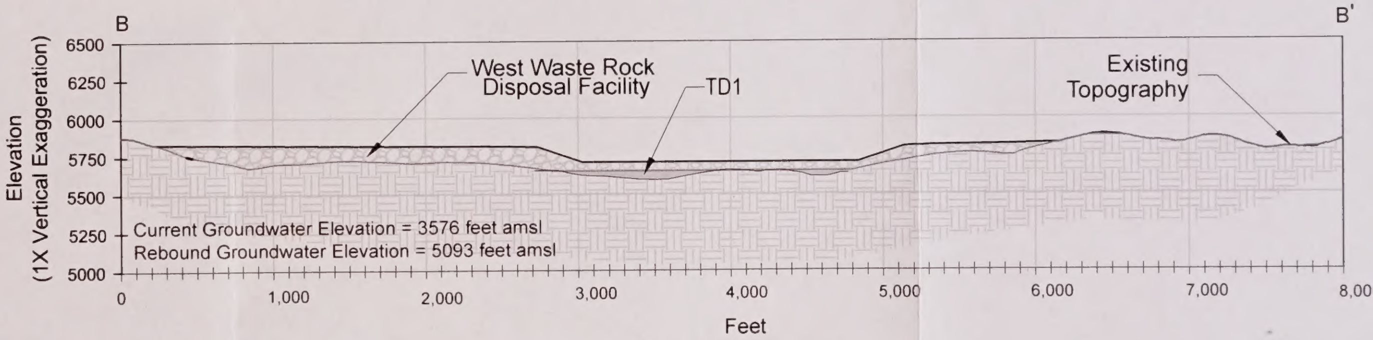


Profile View of A- A'
Scale: 1 inch = 1,000 feet


B'
NORTH
A
North Pit
East Pit
West Waste Rock Disposal Facility
Open Pit
TD1 ET Cell
East Waste Rock Disposal Facility
South Pit
A'
B

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet


B
B'
6500
6250
6000
5750
5500
5250
5000
Elevation
(1X Vertical Exaggeration)
West Waste Rock Disposal Facility
TD1
Existing Topography
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Feet

Profile View of B - B'
Scale: 1 inch = 1,000 feet

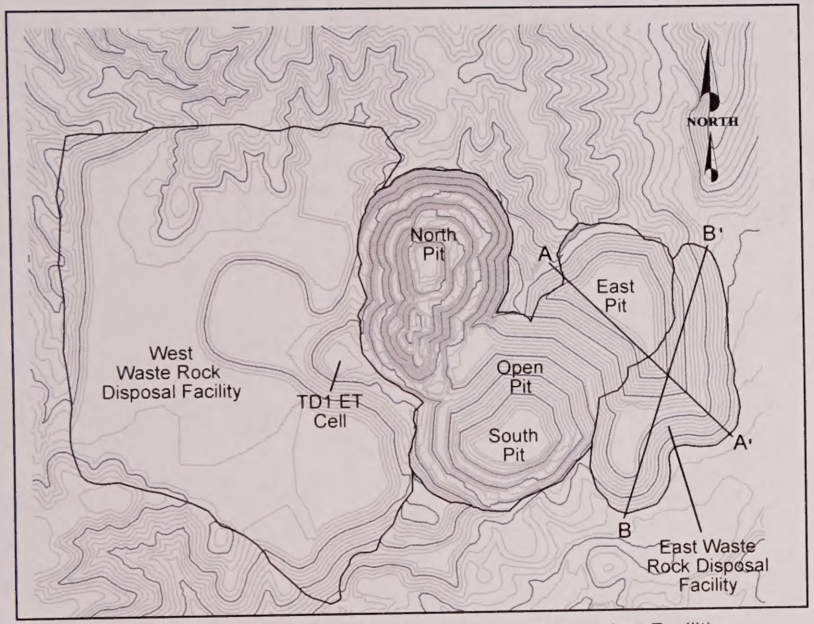
Arturo Mine Project EIS

Figure 2-16

Partial Pit Backfill Alternative Typical Cross-sections of the West WRDF with Reclaimed Slopes

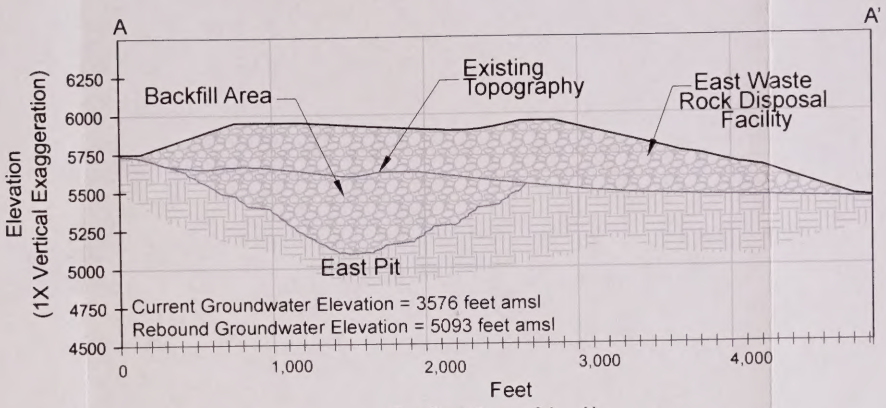
Note: Contours do not reflect WRDF setback distance from open pit or reclamation topography design software.
Source: BDMV 2012.

05/24/12

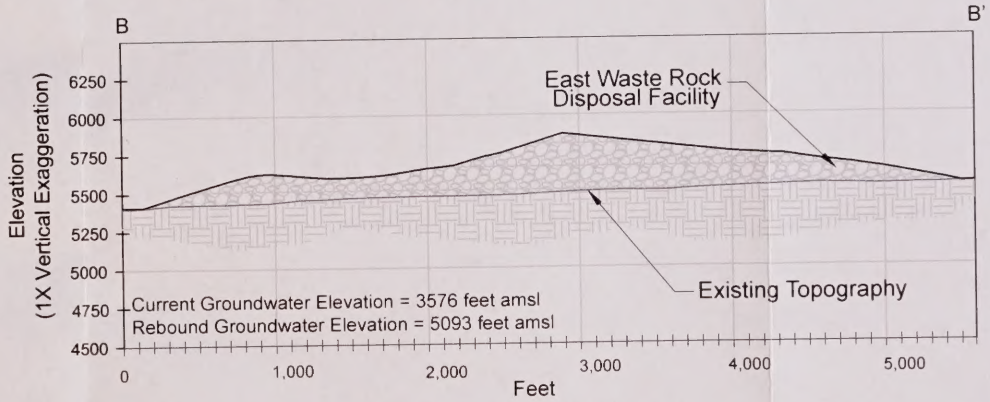

NORTH
North Pit
East Pit
A
B'
West Waste Rock Disposal Facility
TD1 ET Cell
Open Pit
South Pit
A'
B
East Waste Rock Disposal Facility

Contour Intervals Are:
125' Index and 25' Intermediate

Plan View of Proposed Project Facilities
Scale: 1 inch = 3,000 feet


A
A'
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
Backfill Area
Existing Topography
East Waste Rock Disposal Facility
East Pit
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
Feet

Profile View of A - A'
Scale: 1 inch = 1,000 feet


B
B'
Elevation (1X Vertical Exaggeration)
6250
6000
5750
5500
5250
5000
4750
4500
East Waste Rock Disposal Facility
Existing Topography
Current Groundwater Elevation = 3576 feet amsl
Rebound Groundwater Elevation = 5093 feet amsl
0
1,000
2,000
3,000
4,000
5,000
Feet

Profile View of B - B'
Scale: 1 inch = 1,000 feet

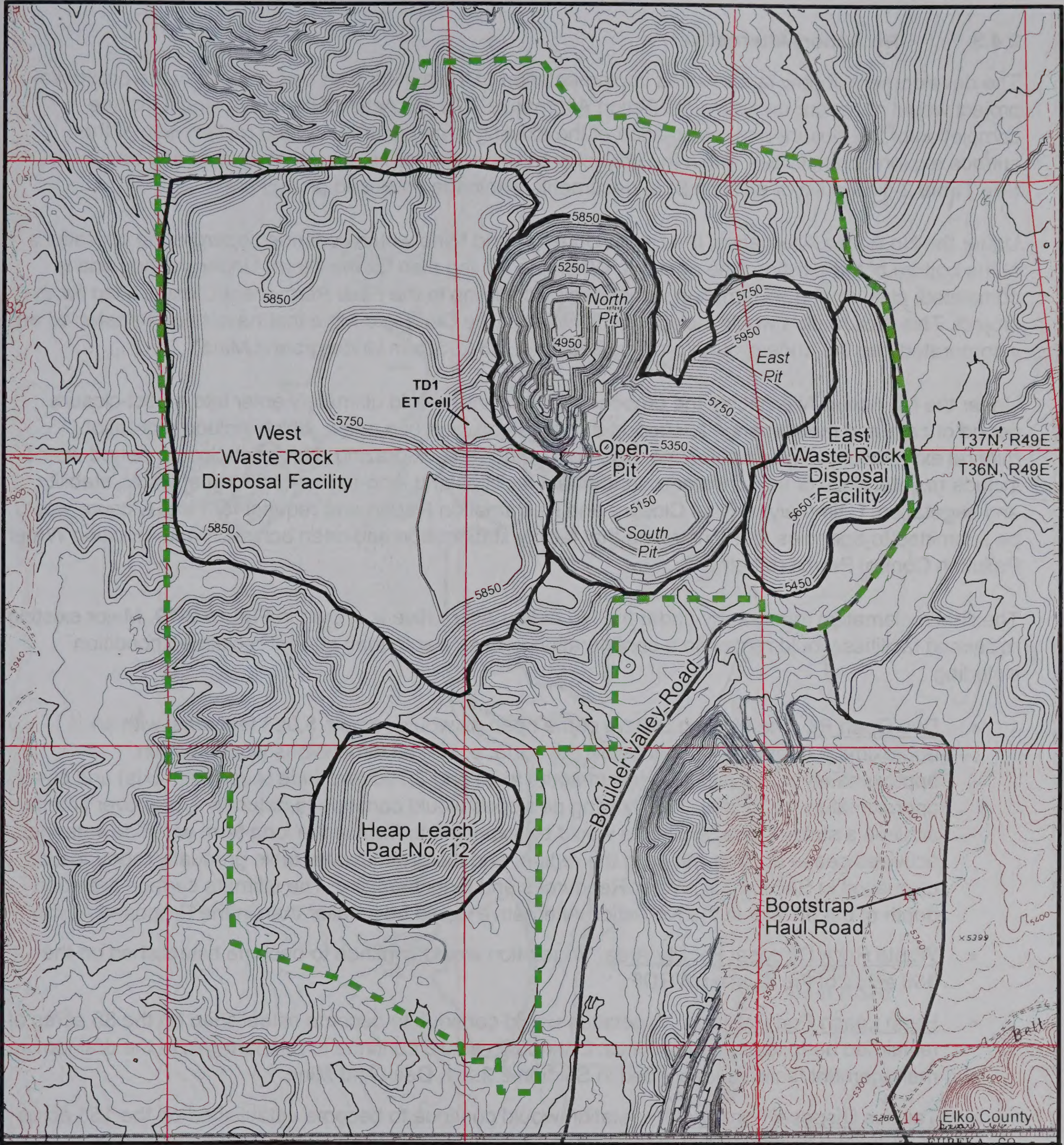
Arturo Mine Project EIS

Figure 2-17

Partial Pit Backfill Alternative Typical Cross-sections of the East WRDF with Reclaimed Slopes

Note: Contours do not reflect WRDF setback distance from open pit or reclamation topography design software.
Source: BDMV 2011a.

05/24/12



Legend

🟩 Proposed PoO Boundary

▭ Proposed Facilities

Note: 20-foot contour interval.
Contours do not reflect WRDF setback distance
from open pit or reclamation topography design software.
Source: BDMV 2011a.

0 0.25 0.5 Miles

Arturo Mine Project EIS

Figure 2-18

Partial Pit Backfill Post-mining Reclamation Topography

5/24/2012

2.4.3 No Action Alternative

The development of new facilities and implementation of the mining plan that comprises the proposed project would not occur under the No Action Alternative. The No Action Alternative would include completion of the closure and reclamation of the existing mine disturbance and reclamation of the surface exploration activities within the project area under the terms of current permits and approvals. See **Table 2-1** for a list of existing BLM documents within the proposed project area.

Under the No Action Alternative, the Storm Underground Mine would continue underground operations at the bottom of the existing Dee open pit. When the mining plan for the Storm Underground Mine is completed, closure and reclamation would begin according to the Final Permanent Closure Plan for the project. This reclamation would include the facilities of the Dee Gold Mine that have been transferred and incorporated into the underground project (Section 2.2.3.2, Storm Underground Mine).

Under the No Action Alternative, the proposed project area would ultimately enter into a post-closure period of care and maintenance to support the long-term land use goals, which include recreation, mineral exploration, wildlife habitat management, and livestock grazing. This post-closure period would include maintenance of storm water management facilities and long-term monitoring of water, stability, and vegetation. Ultimately, a Final Closure and Reclamation Report and request for Final Closure would be submitted to agencies, demonstrating that facility stabilization had been achieved and soliciting Water Pollution Control Permit retirement.

The final reclamation topography under the No Action Alternative is shown in **Figure 2-19**. Major existing reclaimed facilities would remain in a configuration very similar to their current reclaimed condition including:

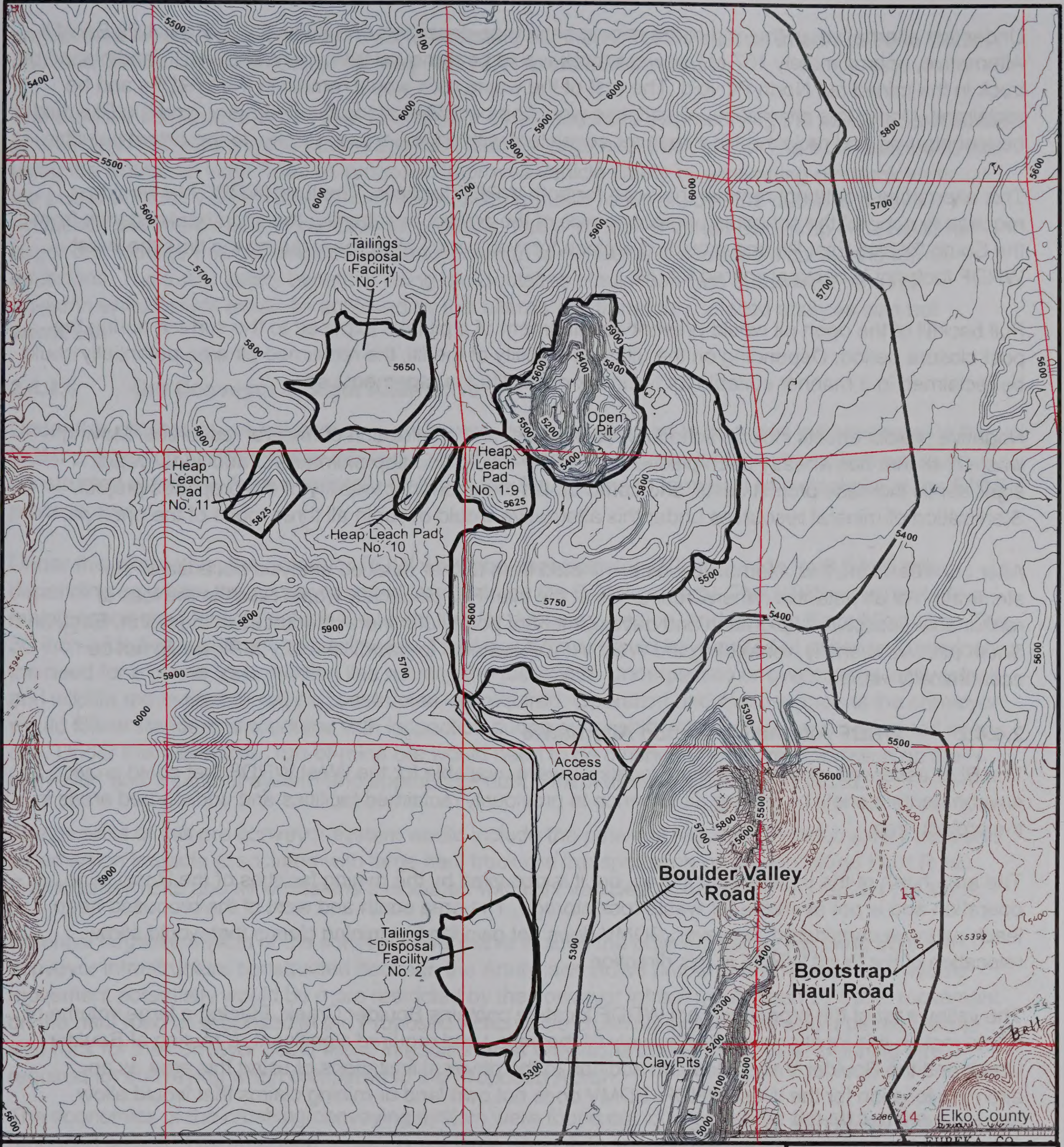
- Dee Open Pit. The existing bottom of the open pit would remain 5,053 feet amsl with an approximate depth of 780 feet below the surface. The pit dimensions would remain approximately 3,300 feet long (north-south axis) and 2,700 feet wide (east-west axis) and cover approximately 130 acres. The existing pit slopes would continue to naturally erode over time to achieve a stable slope. A pit lake would be expected to form in the long term when dewatering activities cease at other mines in the region, and the groundwater table gradually rebounds, as discussed in Section 3.4, Water Resources and Geochemistry. The ultimate surface area and depth of the pit lake in the No Action Alternative would be smaller than in the Proposed Action.
- Waste Rock Disposal Facility Area. Vegetation would continue to become established on the 368 acres of the existing WRDF.
- Heap Leach Pad Facilities. Vegetation would continue to become established on the 85 acres of reclaimed heap leach pad facilities. Draindown would continue to be managed in the draindown management facilities, described in Section 2.2.3.1, Dee Gold Mine.
- Tailings Disposal Facilities. Vegetation would continue to become established on the 156 acres of reclaimed tailings disposal facilities. Seepage and surface water would continue to be managed in the existing TD1 ET Cell.

2.4.4 Alternatives Considered but Eliminated from Detailed Analysis

This section describes the alternatives considered but subsequently eliminated from detailed analysis by the BLM and the rationale for their elimination. The alternatives were considered with regard to their ability to address the identified purpose and need, their technological and economic feasibility, as well as their potential to address environmental issues and reduce potential impacts.

2.4.4.1 Full Pit Backfill Alternative

Under this alternative, mining would be sequenced in the same manner as the Partial Pit Backfill Alternative, adding in the additional step of filling the open pit completely at the end of the project by moving waste rock from the WRDF.



Legend

▭ Existing Facilities

Source: BDMV 2011a.

Arturo Mine Project EIS

Figure 2-19

No Action Alternative Reclamation Topography

05/24/2012

Under this alternative, at the end of the mining sequence described in Section 2.4.2, Partial Pit Backfill Alternative, approximately 167 MT of waste rock would be removed from the West WRDF and placed by truck in the mined out North Pit void. The rest of the waste rock would remain in the WRDFs and be reclaimed. Under this alternative, all pit lobes would be backfilled along the perimeter, and the fill would be recontoured and reclaimed in a manner consistent with adjacent topography, to the extent possible.

This alternative would not remove the need for both WRDF facilities. The East WRDF still would be required to support the schedule and economics of the project by retaining the short haul distance from the South Pit and East Pit and providing a place for waste rock placement during the time the West WRDF footprint is being prepared for use.

Full backfill of the open pit would prevent development of a pit lake exposed to the surface during the post-closure period. Depending on the ultimate stability of the fill, the reclaimed pit area potentially could be reclaimed in a manner suitable for livestock or wildlife management use.

Negative project effects include schedule, economics, and sterilization of mineral resources. Moving waste rock that has already been placed in a WRDF would add approximately 3 additional years, significantly increase project costs, and compromise the economic viability of the proposed project. Sterilization of mineral resources under this alternative would occur in all three lobes of the open pit.

After consideration, this alternative was eliminated from further detailed analysis because of the sterilization of all potential mineral resources at the site. Full pit backfill would result in the loss of reasonable access to exploration and development of potential mineral resources in the North, East, and South pits. Additionally, rehandling the West WRDF material to backfill the North Pit would not be economically viable.

2.4.4.2 WRDF Alternate Location Alternative

The BLM assessed whether alternate locations were available for the West WRDF that could provide an environmental benefit by limiting disturbance to previously reclaimed facilities and undisturbed areas in the project area.

The area north of the pit was considered, but it is occupied by the mining facilities of the Rossi Mine operation and is not available for waste rock storage. The area south and west of the proposed heap leach pad was considered; however, BDMV does not own land or mining claims that would allow relocation of the West WRDF in this direction.

The valley east of the proposed East WRDF location contains Boulder Creek. Placing a large volume of waste rock in this location would effectively fill the valley and required significant re-routing of Boulder Creek and the Boulder Valley Road. In addition to the physical limitations of using this area as an alternate location for the West WRDF, BDMV does not own land or mining claims that would allow placement of waste rock in this area.

The possibility of relocating the West WRDF to a different area was reviewed; however, the physical barriers, lack of land ownership, and potential haul distances limit suitable locations. As a result, this alternative was eliminated from further consideration.

2.4.4.3 Ore Truck Haulage Route Alternatives

An alternative route to transport mill-grade ore from the proposed project site to BGMI for processing was considered. Rather than widening the Bootstrap Haul Road for large off-road haul trucks, a combination of the Boulder Valley Road and the existing Bootstrap Haul Road would be used to transport ore with smaller highway-sized trucks in one haulage route alternative. In another mill-grade ore haulage alternative considered, smaller highway sized trucks would travel 28 miles south from the project area on the Boulder Valley Road to Interstate 80, then 27 miles east on Interstate 80 to Carlin, and then 30 miles north on State Highway 766/237A to the BGMI property.

The BLM did not identify any benefit to wildlife or other resources by preserving the existing configuration of roads and not widening the Bootstrap Haul Road for large haul truck traffic. The BLM concluded that using the Bootstrap Haul Road as proposed improves vehicle safety by eliminating ore truck traffic on the public Boulder Valley Road. Travel routes utilizing public roads expose the public to potential accidents, use more fuel and increase air pollution. The proposed widened Bootstrap Haul Road for larger ore haulage trucks increases efficiency through lower fuel and equipment costs, and lower emissions. The traffic safety benefit of using the Bootstrap Haul Road was substantial, and no environmental benefit would be achieved by this alternative; therefore, detailed analysis was not warranted.

2.4.4.4 Ore Conveyor System Alternative

Under this alternative, an ore conveyor system would be constructed to transport mill-grade ore to the BGMI processing facilities rather than using haul trucks. Conceptually, a conveyor system would be constructed extending from a stockpile facility at the Arturo Mine to terminate at a stockpile at the BGMI process area.

Under this alternative, the conveyor ROW would be approximately 100 feet wide for 3.5 to 5 miles, depending on where the conveyor would terminate on the BGMI property. The ROW would include a maintenance road for light vehicles, a water line for dust suppression, and fencing for public safety. The 36-inch-wide belt would run approximately 4 feet ags. Power would be supplied at either end, eliminating the need for a power transmission line running the full length. Underpasses or overpasses for livestock and wildlife movement would be constructed, as required. Operation and maintenance of the conveyor would follow standard procedures with inspection during every shift with maintenance performed every day. Under this alternative, run-of-mine ore would need to be crushed prior to transportation on the conveyor, and a crusher system and appropriate dust control devices would be included.

The benefits of this ore conveyor system would include the potential reduction in traffic safety risks and air emission impacts associated with large haul truck ore transportation on the Bootstrap Haul Road. Traffic safety risks and air emissions associated with light vehicles would, however, remain the same.

Potential negative effects of the conveyor alternative include the physical barrier resulting from the conveyor infrastructure constructed between the Arturo and BGMI properties. Livestock and wildlife movement potentially would be more restricted by the conveyor infrastructure than by traffic movement on the haul road as proposed in the Proposed Action. The crushing system that would be required to size rock for the conveyor could result in additional air emissions due to the smaller crushing size required for conveying when compared to the Proposed Action.

The economics of the crushing/conveying system were found not to be viable for the size of the proposed project. The proposed project is not large enough to support the capital investment necessary for the crushing and conveying system. While other mine operations in northern Nevada have recently utilized conveyor haulage, these tend to be larger mine operations with longer mine lives where transportation of more ore tons provides an economy of scale for conveyor haulage.

This alternative was eliminated from detailed analysis based on economic feasibility.

2.4.4.5 Underground Mining Alternative

Under this alternative, the expansion of the open pit would be eliminated, and mining would be accomplished using underground methods. Ore from the Arturo deposit would be mined at a rate of 1,500 tpd from an underground mine accessed via declines from the existing Dee open pit. Existing support facilities located in the Dee open pit for the Storm Underground Mine would be used for equipment maintenance, change houses, and offices.

Underground mining costs are substantially higher than open-pit mining costs. As a result, underground mining methods require high-grade mineral deposits that can support these higher costs. Due to the low average mineral grade of the Arturo deposit, approximately 76 percent of the mineral resource would be eliminated if the deposit were restricted to underground mining methods. Based on experience with the Storm Underground Mine, BDMV determined that the Arturo deposit could not be economically mined by underground methods.

After consideration, this alternative was eliminated from detailed consideration because underground mining is not economically feasible for the characteristics of the Arturo ore body.

2.5 BLM-preferred Alternative

In accordance with NEPA, federal agencies are required by Council on Environmental Quality (40 CFR 1502.14) to identify their preferred alternative for a project in the Draft EIS, if a preference has been identified, and in the Final EIS prepared for the project. The preferred alternative is not a final agency decision; rather, it is an indication of the agency's preference. The BLM-preferred alternative for the Arturo Mine Project is the Proposed Action.

3.0 Affected Environment and Environmental Consequences

3.1 Introduction

This chapter summarizes the affected environment and environmental consequences for the proposed project and alternatives analyzed in this Environmental Impact Statement (EIS). It also includes a description of the past, present, and reasonably foreseeable future actions (RFFAs) that may result in cumulative impacts with the proposed project or alternatives.

Alternatives analyzed in this chapter include the Proposed Action, No Action, Single Waste Rock Disposal Facility (WRDF) Alternative (shallow waste rock cover placement over Tailings Disposal Facility No. 1 [TD1] site), and the Partial Pit Backfill Alternative. The Single WRDF Alternative (deep waste rock cover placement over TD1 site) was eliminated from detailed analysis and is described in Section 2.4.1, Single WRDF Alternative.

The baseline information summarized in this chapter was obtained from published and unpublished materials; discussions with local, state, and federal agencies; field and laboratory studies conducted in the project area; and on-site experience with mining and reclamation. The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the proposed project. For resources such as soils and vegetation, the affected area was determined to be the physical location and immediate vicinity of the areas to be disturbed by the proposed project. For other resources such as water quality, air quality, wildlife, social and economic values, and the transport of hazardous materials, the affected environment analysis covers a larger area, as described in each resource section.

This chapter also describes the anticipated direct and indirect impacts of the proposed project and the alternatives, as well as potential cumulative impacts. The analysis of potential impacts from the proposed project assumes the implementation of regulatory requirements and the applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures), that would be implemented in association with the proposed project. Mitigation and monitoring developed in response to anticipated impacts for individual resources are discussed by the Bureau of Land Management (BLM) at the end of each resource section. This chapter also identifies residual impacts, which are impacts that would remain after mitigation measures have been implemented.

The proposed project may result in cumulative effects associated with other past, present, and RFFAs in the area. BLM NV-90-435 specifies that impacts first must be identified for the proposed project before cumulative impacts with past, present, and RFFAs can be assessed. For resources where project-specific impacts are identified, the cumulative effects associated with the proposed project were evaluated together with other past, present, and RFFAs. The period of potential cumulative impact is defined as the approximately 8-year mine life of the project followed by 4 years of reclamation. The cumulative effects analysis for each resource addressed the potential cumulative effects within the resource-specific cumulative effects study area (CESA). Cumulative effects, including descriptions of and rationale used to develop CESAs, are discussed on a resource-by-resource basis in Chapter 3.0.

The project area for the Proposed Action is the area including the Plan of Operations boundary and other proposed elements including the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor. Elements of the project area are shown in **Figure 2-2**.

The study area is the area assessed for direct and indirect impacts and is defined individually for each resource, and may or may not be the same as the project area. The study area is defined as the region where direct and indirect impacts would occur for a specific resource as a result of the Proposed Action. Direct and indirect impacts would occur within the project area for most affected resources; some indirect impacts may affect the adjacent or immediate area surrounding the project area.

The CESA also is defined individually for each resource, and includes a larger area than the study area assessed for direct and indirect impacts. Project region is defined as an area larger than the CESA and is a more generalized area without specific boundaries.

The proposed project does not require dewatering of the proposed open pit; therefore, there are no resource impacts from dewatering under the proposed project. Dewatering operations at the Barrick Goldstrike Mines Inc. facility have lowered the water table below the maximum depth of the proposed pit, which would allow the proposed project to operate without additional dewatering activities.

Section 2.2.3, Existing Facilities, describes existing facilities in the project area, including mining operations by the Storm Underground Mine, and the continuation of authorized exploration activities within the project area. Section 2.4.3, No Action Alternative, describes the activities that would continue at the Dee Gold Mine under the No Action Alternative. These activities or facilities would continue to operate at the Dee Gold Mine under existing authorizations (**Table 2-1**).

After an introduction and description of past, present, and RFFAs, this chapter is organized according to the affected resource topics. Subsections for each resource include:

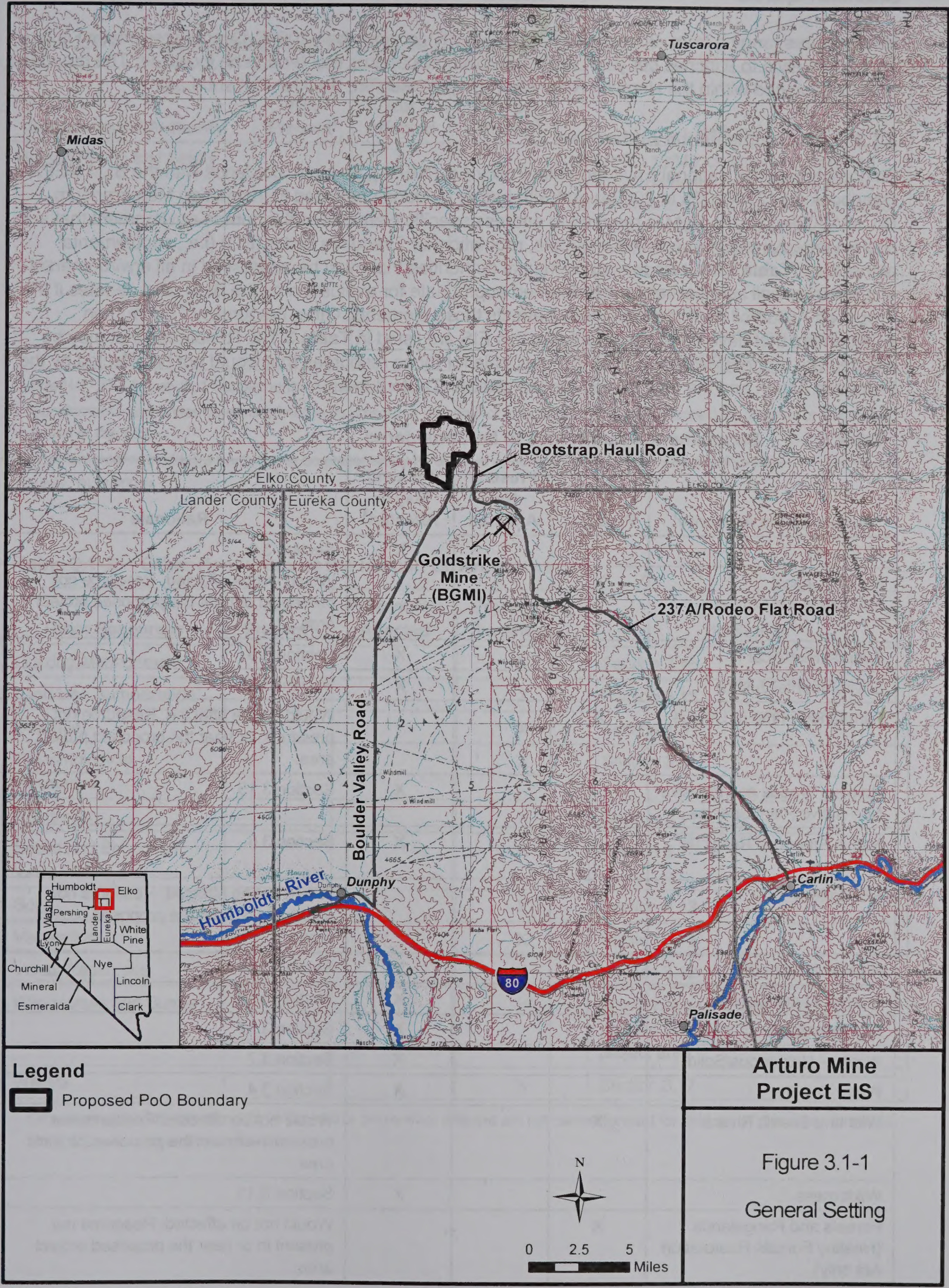
1. Affected Environment;
2. Environmental Consequences (of each alternative);
3. Cumulative Impacts;
4. Monitoring and Mitigation; and
5. Residual Impacts.

Energy requirements for the Proposed Action and alternatives are provided in Section 3.22, Energy Requirements and Climate Change. The short-term use of the environment relative to the long-term productivity of resources is discussed in Section 3.23, Relationship Between Short-term uses of the Human Environment and the Maintenance and Enhancement of Long-term Productivity. Short-term is defined as the life of the proposed project or less (proposed plan is 8 years of mine operation followed by 4 years of reclamation). Long-term impacts are defined as impacts that would continue post-reclamation and closure. The irreversible or irretrievable commitment of resources is described in Section 3.24, Irreversible and Irretrievable Commitment of Resources.

3.1.1 General Setting

The proposed Arturo Mine Project is located in northern Nevada as shown in **Figure 3.1-1**. The surrounding terrain consists of alternating mountain ranges and sagebrush-covered valleys, with the proposed project site situated in the Basin and Range physiographic province. This region is characterized by large, extensive valleys located between mountain ranges. The proposed project is located at the northern end of Boulder Valley with the Sheep Creek Range to the southwest and the Tuscarora Mountains to the east and north.

Elevations at the project location range from approximately 5,200 feet to 6,100 feet above mean sea level. The climate is marked by extreme weather conditions characterized as arid and accompanied by



Arturo Mine Project EIS

Figure 3.1-1

General Setting

04/12/2012

temperatures ranging from -20 degrees Fahrenheit (°F) to more than 100°F. Overall precipitation is approximately 5 to 9 inches per year, with erratic rainfall patterns that tend to be localized. The proposed project is located within the Humbolt River Hydrographic Region, Boulder Flat sub-basin.

3.1.2 Supplemental Authorities

To comply with the National Environmental Policy Act (NEPA), and in accordance with the BLM NEPA Handbook (H-1790-1) (BLM 2008a) and with further guidance provided in Instruction Memorandum No. NV-2009-030, the BLM is required to address specific elements of the human environment that are subject to requirements specified in statute, regulation, or Executive Order (EO) (i.e., supplemental authorities). **Table 3.1-1** lists the supplemental authorities that must be addressed in all environmental analyses, as well as other resources deemed appropriate for evaluation by the BLM, and denotes if the Proposed Action or No Action Alternative affects those elements. Other resources of the human environment that have been considered for this EIS are listed in **Table 3.1-2**. Resources that may be affected are further described in the EIS; rationale for those resources that would not be affected by the Proposed Action and the alternatives are identified in **Table 3.1-2**.

Table 3.1-1 Supplemental Authorities to be Considered

Supplemental Authority[1]	Not Present[2]	Present/ Not Affected	Present/ May be Affected[3]	Rationale
Air Quality			X	Section 3.8
Area of Critical Environmental Concern	X			Would not be affected. Resource not present in or near the proposed project area.
Cultural/Historical			X	Section 3.5
Environmental Justice			X	Section 3.21
Farmlands Prime or Unique	X			Would not be affected. Resource not present in or near the proposed project area.
Noxious Weeds and Invasive Non-native Plant Species			X	Section 3.15
Native American Religious Concerns			X	Section 3.6
Floodplains	X			Would not be affected. Resource not present in or near the proposed project area.
Riparian/Wetlands			X	Section 3.14
Special Status Species			X	Section 3.18
Migratory Birds			X	Section 3.17
Waste – Hazardous/Solid			X	Section 3.7
Water Quality			X	Section 3.4
Wild and Scenic Rivers	X			Would not be affected. Resource not present in or near the proposed project area.
Wilderness			X	Section 3.11
Forests and Rangelands (Healthy Forests Restoration Act only)	X			Would not be affected. Resource not present in or near the proposed project area.

Table 3.1-1 Supplemental Authorities to be Considered

Supplemental Authority[1]	Not Present[2]	Present/ Not Affected	Present/ May be Affected[3]	Rationale
Human Health and Safety		X		Under EO 13045, children are protected from environmental health and human safety risks. In accordance with EO 13045, the Proposed Action would not use pesticides or herbicides in locations where children would be exposed. Therefore, the Proposed Action poses no health and human safety risk as it relates to EO 13045, and health and human safety is not addressed further in this EIS.

[1] See H-1790-1 Appendix 1 Supplemental Authorities to be Considered.

[2] Supplemental authorities determined not to be present or present/not affected are not carried forward for analysis or discussed further in this EIS.

[3] Supplemental authorities determined to be present/may be affected are carried forward for analysis in this EIS.

Source: BLM 2008a.

Table 3.1-2 Other Resources of the Human Environment

Other Resources	Not Present[1]	Present/Not Affected	Present/May be Affected	Rationale
Grazing Management			X	Section 3.16
Land Use Authorization			X	Section 3.19
Minerals			X	Section 3.3
Paleontological Resources			X	Section 3.9
Recreation			X	Section 3.11
Social and Economic Values			X	Section 3.10
Soils			X	Section 3.13
Vegetation			X	Section 3.14
Visual Resources			X	Section 3.12
Wild Horses and Burros	X			Would not be affected. Resource not present in or near the proposed project area.
Wildlife			X	Section 3.17

[1] Other resources determined not to be present or present/not affected are not carried forward for analysis or discussed further in this EIS based on the rational provided.

3.2 Past, Present, and Reasonably Foreseeable Future Actions

This section summarizes past, present, and reasonably foreseeable future actions (RFFAs) for the Proposed Action and forms the basis for the discussion of cumulative impacts. Cumulative impacts are defined by the Council on Environmental Quality as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (40 Code of Federal Register 1508.7).

Bureau of Land Management (BLM) Instruction Memorandum NV-90-435 specifies that impacts first must be identified for the proposed project before cumulative impacts with past, present, and RFFAs can occur. Cumulative effects are discussed on a resource-by-resource basis in Chapter 3 sections, including the description of and rationale used to develop individual resource cumulative effects study areas.

Relevant projects and actions are defined for the Environmental Impact Statement (EIS) as those past, present, and RFFAs that could interact with the Proposed Action or alternatives in a manner that would result in cumulative impacts, resulting primarily from mining, commercial activities, and public uses.

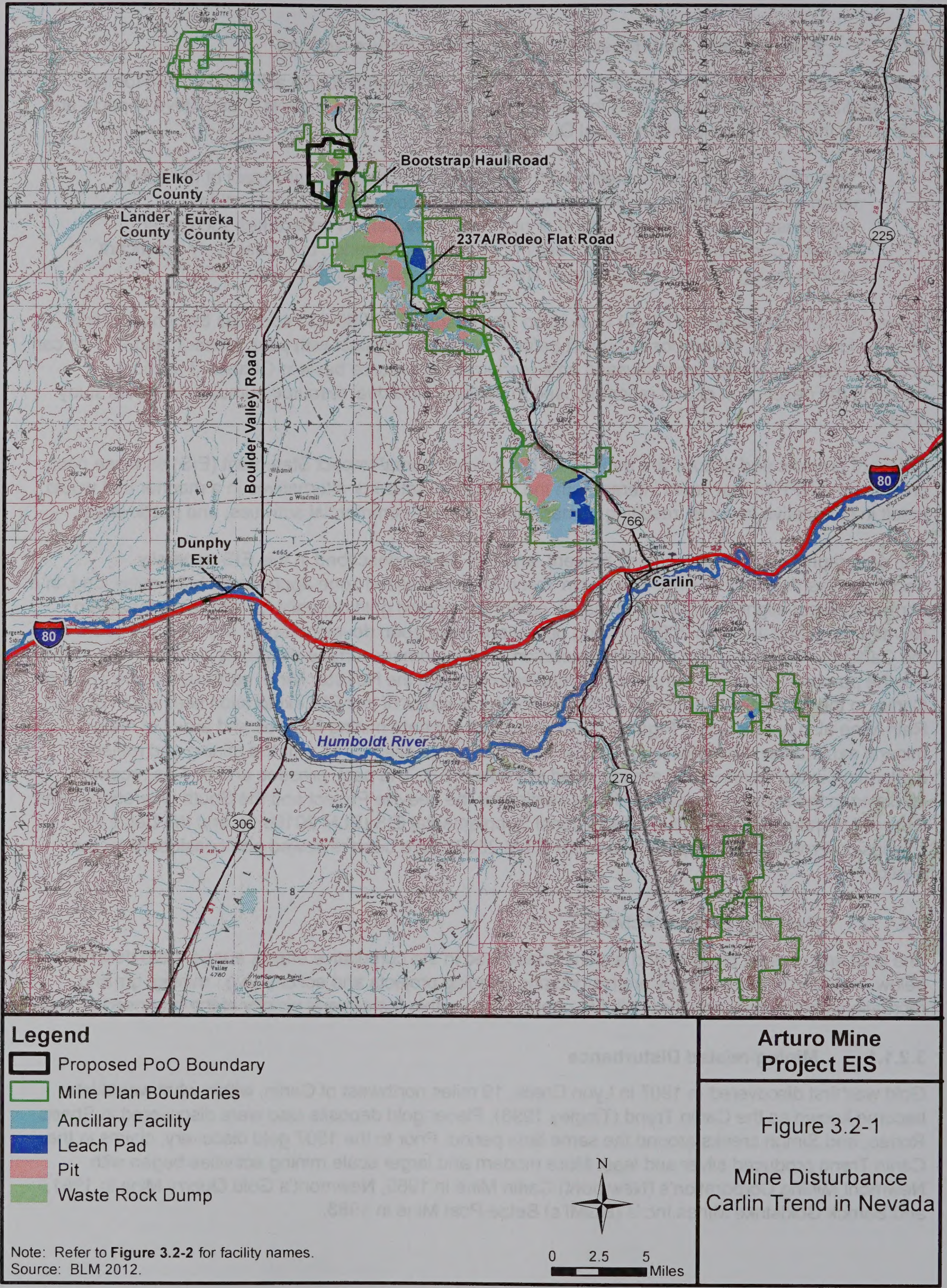
The geographic area for which past, present, and RFFAs are described in this EIS generally encompasses the Carlin Trend. The Carlin Trend is a mineralized zone approximately 38 miles long, in a north-northwest alignment of predominately carbonate-hosted gold deposits located in northeastern Nevada (Teal and Jackson 2002). Mining operations have been developed over the past 100 years on the Carlin Trend. Mining and mineral exploration are the primary surface-disturbing actions in the vicinity. For the purposes of this EIS, the Carlin Trend extends from the Hollister Mine, northwest of the Town of Carlin, to the Rain Mine, southeast of Carlin. For the purpose of this EIS exploration sites south of the Rain Mine also are included. **Figures 3.2-1** and **3.2-2** illustrate mining facilities and areas of major mineral exploration in the vicinity of the Carlin Trend. Acres associated with the mining and mineral exploration in the Carlin Trend are identified in **Table 3.2-1**. The past, present, and RFFAs recently identified in the mining cumulative effects studies for the Leeville Project and the South Operations Area Project Amendment Cumulative Effects, Final Supplemental EIS (BLM 2010a,b), and the Betze Pit Expansion Project, Final Supplemental EIS (BLM 2009) have been reviewed and considered for this section.

3.2.1 Past and Present Actions

The past and present projects and actions considered in the cumulative effects analysis are described below. Included in this category are historic and ongoing projects and actions (e.g., mining, grazing, recreation, commercial activities, wildfire phenomena) within the general vicinity of the proposed project.

3.2.1.1 Mining-related Disturbance

Gold was first discovered in 1907 in Lynn Creek, 19 miles northwest of Carlin, within what would later become known as the Carlin Trend (Tingley 1998). Placer gold deposits also were discovered in Sheep, Rodeo, and Simon creeks around the same time period. Prior to the 1907 gold discovery, claims in the Carlin Trend produced silver and lead. More modern and larger scale mining activities began with Newmont Mining Corporation's (Newmont) Carlin Mine in 1965, Newmont's Gold Quarry Mine in 1981, and Barrick Goldstrike Mines Inc.'s (BGMI's) Betze-Post Mine in 1988.



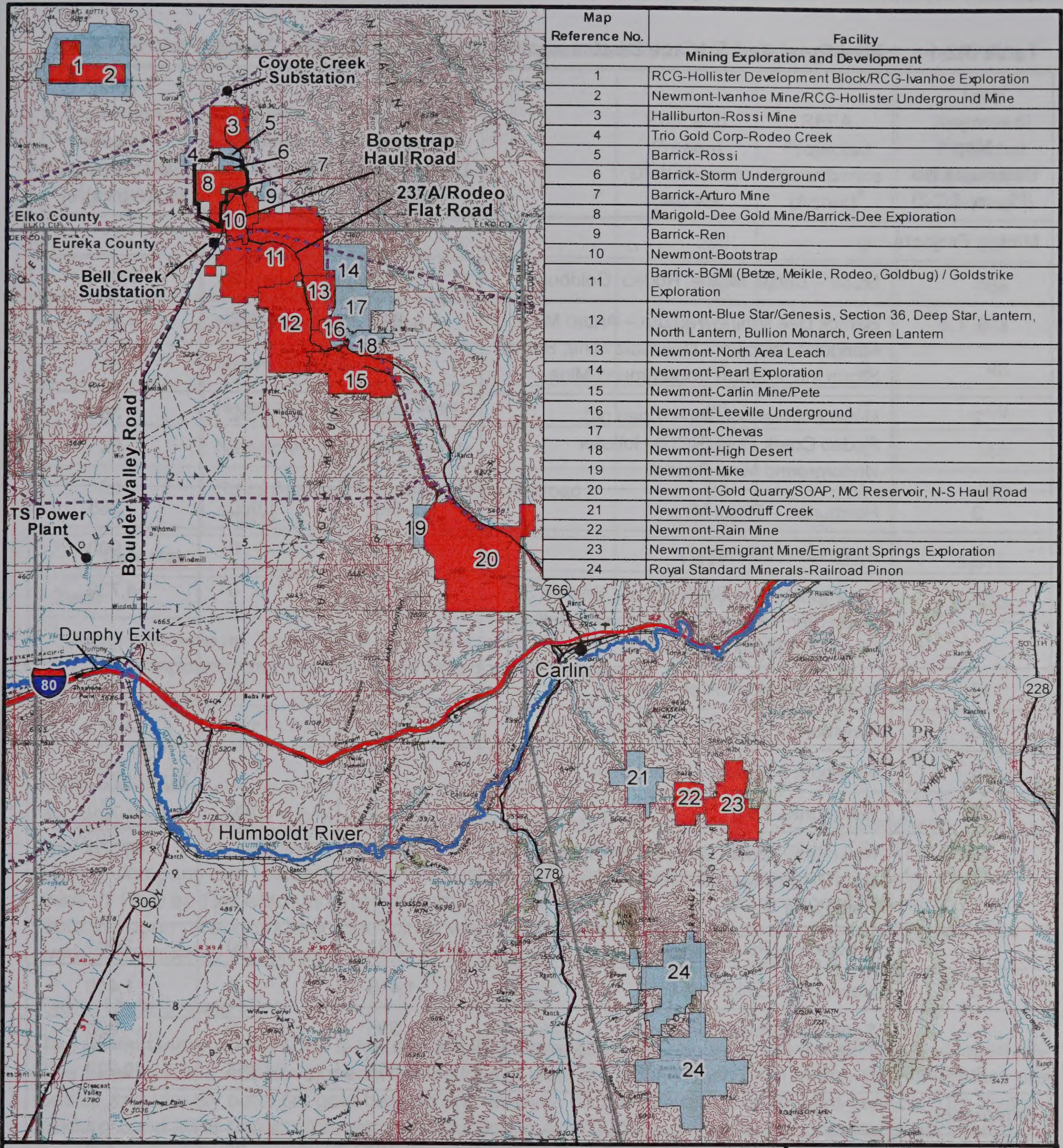
Note: Refer to **Figure 3.2-2** for facility names.
Source: BLM 2012.

Arturo Mine Project EIS

Figure 3.2-1

Mine Disturbance Carlin Trend in Nevada

05/24/2012



Map Reference No.	Facility
Mining Exploration and Development	
1	RCG-Hollister Development Block/RCG-Ivanhoe Exploration
2	Newmont-Ivanhoe Mine/RCG-Hollister Underground Mine
3	Halliburton-Rossi Mine
4	Trio Gold Corp-Rodeo Creek
5	Barrick-Rossi
6	Barrick-Storm Underground
7	Barrick-Arturo Mine
8	Marigold-Dee Gold Mine/Barrick-Dee Exploration
9	Barrick-Ren
10	Newmont-Bootstrap
11	Barrick-BGMI (Betze, Meikle, Rodeo, Goldbug) / Goldstrike Exploration
12	Newmont-Blue Star/Genesis, Section 36, Deep Star, Lantern, North Lantern, Bullion Monarch, Green Lantern
13	Newmont-North Area Leach
14	Newmont-Pearl Exploration
15	Newmont-Carlin Mine/Pete
16	Newmont-Leeville Underground
17	Newmont-Chevas
18	Newmont-High Desert
19	Newmont-Mike
20	Newmont-Gold Quarry/SOAP, MC Reservoir, N-S Haul Road
21	Newmont-Woodruff Creek
22	Newmont-Rain Mine
23	Newmont-Emigrant Mine/Emigrant Springs Exploration
24	Royal Standard Minerals-Railroad Pinon

Legend

- ☐ Proposed PoO Boundary
- 🟦 Area of Current Major Exploration
- 🟥 Areas of Existing and Reasonably Foreseeable Development as Defined by Mine Plan Boundary
- ---- Power Transmission Line

0 2.5 5 Miles

Source: BLM 2012.

Arturo Mine Project EIS

Figure 3.2-2

Past, Present, and Reasonably Foreseeable Future Mining Actions Carlin Trend in Nevada

05/24/2012

Table 3.2-1 Mining-related Surface Disturbance Associated with Past, Present, and RFFAs

Map Reference No. (Figure 3.2-2)	Action	Past and Present Disturbance (Acres)	RFFA Projected Disturbance (Acres)[1]	Total Approved/ Projected Disturbance (Acres)[1]
Mining Projects				
11	BGMI – Betze, Meikle, Rodeo, Goldbug	9,062	0	9,062
6, 7,8	Barrick Dee Mining Venture – Arturo Mine, Marigold/Goldcorp – Dee Gold Mine, Barrick Storm Inc. – Storm Underground Mine	812	1,962	2,774
2	Newmont-Ivanhoe Mine (open pit) Rodeo Creek Gold (RCG)-Hollister Underground Mine Project	268	92	360
3	Halliburton – Rossi Mine	585	1,000	1,585
10	Newmont – Bootstrap	1,900	0	1,900
12	Newmont – Blue Star/Genesis, Section 36, Deep Star, Lantern, North Lantern, Bullion Monarch, Green Lantern	4,739	0	4,739
13	Newmont – North Area Leach	1,526	0	1,526
15	Newmont – Carlin Mine/Mill, Pete	3,673	100	3,773
16	Newmont – Leeville Underground	566	0	566
19	Newmont – Mike	0	100	100
20	Newmont – Gold Quarry/South Operations Area Project, Maggie Creek Reservoir, N-S Haul Road	9,961	1,000	10,961
22	Newmont – Rain Mine	961	100	1,061
23	Newmont – Emigrant Mine	1,418	0	1,418
--	Sand and Gravel Operations	395	0	395
Subtotal		**35,866**	**4,354**	**40,220**
Exploration [2]				
1	RCG – Hollister Development Block, Ivanhoe Exploration	95	25	120
4	Trio Gold Corp – Rodeo Creek	42	0	42
5	Barrick – Rossi	51	0	51
8	Barrick – Dee Exploration	84	0	84
9	Barrick – Ren	30	30	60
11	Barrick – Goldstrike Exploration	233	0	233
14	Newmont – Pearl Exploration Project	0	206	206

Table 3.2-1 Mining-related Surface Disturbance Associated with Past, Present, and RFFAs

Map Reference No. (Figure 3.2-2)	Action	Past and Present Disturbance (Acres)	RFFA Projected Disturbance (Acres)[1]	Total Approved/ Projected Disturbance (Acres)[1]
15	Newmont – Carlin	255	0	255
17	Newmont – Chevas	168	0	168
18	Newmont – High Desert	164	0	164
19	Newmont – Mike	48	0	48
21	Newmont – Woodruff Creek	66	0	66
23	Newmont – Emigrant Springs	155	0	155
24	Royal Standard Minerals – Piñon Railroad Project	20	200	220
Subtotal		**1,411**	**461**	**1,872**
Total		**37,277**	**4,815**	**42,092**

[1] Approximate acreages. Acreages to change upon submittal of the Plan of Operations (PoO).

[2] PoO level exploration programs (more than 5 acres of surface disturbance).

Source: BLM 2012.

Dee Gold Mine

As described in Chapter 2.0, the Dee deposit (located within the proposed PoO boundary) was discovered in 1981 and began production in 1984 under the operating partnership of the Dee Gold Mining Company and Rayrock Mines Inc. Glamis Gold Ltd. became the operator of the Dee open pit mine in 1999 and initiated underground production from the Dee Deep North deposit that same year. Both the open pit and underground mines were shut down in 2000. Reclamation and closure activities were subsequently completed for most of the Dee Gold Mine facilities by 2009.

Storm Underground Mine

The Storm Underground Mine is located within the proposed PoO boundary in the existing Dee open pit. The Storm decline was developed from the lowest level of the Dee open pit in March 1999 to explore ore bodies and identify potential gold-bearing ore reserves on the Barrick-Meridian joint-venture. The Storm Underground Mine began commercial production in April 2007 and is an active ongoing project that is currently scheduled to end in 2012. Approximately 195 acres of surface disturbance is associated with the Storm Underground Mine.

Rossi Mine

Halliburton's open-pit barite Rossi Mine is located north of the proposed PoO Boundary and has been producing barite since 1947. The Rossi Mine project includes open pits at both the Queen Lode and Sage Hen barite deposits, Waste Rock Disposal Facilities (WRDFs), haul roads, ore stockpiles, jig plant, ponds, and surface exploration activities. The mine is permitted for another 15 years of operations and approximately 585 acres of disturbance. No dewatering is associated with the Rossi Mine.

BGMI

The BGMI facility, where the mill-grade ore from the Arturo Mine project would be processed, is located approximately 3.5 miles to the south and east of the proposed project area within the Lynn Creek Mining District. BGMI includes the Betze Pit, Meikle and Rodeo underground mines, processing facilities, WRDFs, tailings disposal facilities, and ancillary support facilities. Western States Minerals initiated mining in the area of the Betze-Post Mine in 1986. BGMI acquired the mine in 1988, expanded operations, and has continued mining to the present. Current disturbances are associated with the roads, reclaimed leach pad, mill and processing facilities, and ancillary support facilities. BGMI's Betze Pit Expansion Project, approved by the BLM in 2009, consists of the expansion of the open pit, construction of the Clydesdale WRDF and construction of a new tailings disposal facility. The ore processing life of the Betze Pit Expansion Project is expected to extend 19 years. BGMI dewatering operations discharges into the Boulder Valley. The dewatering operations are monitored and reported to agencies under the approved Boulder Valley Monitoring Plan.

North Operations Area

Newmont's North Operation Area includes all of Newmont's mining operations located between (and inclusive of) the Bootstrap Mine to the north and the Pete Mine to the south. A summary of past and present actions within Newmont's North Operations Area is provided as follows:

- The Bootstrap Mine is directly south of the proposed project area between the Dee Gold Mine and BGMI along the Bootstrap Haul Road. Mining operations at the Bootstrap open-pit occurred from 1974 to 1984. Closure and reclamation were completed at the mine in 1988. Mining operations at the Bootstrap Mine were reinitiated by Newmont in 1996 with the development of the Bootstrap, Capstone, and Tara gold deposits. In 2000, mining operations ceased and Newmont reclaimed most of the surface disturbance including backfilling, recontouring, and seeding the Capstone open pit by 2005. Remaining surface disturbance associated with this site includes 248 acres of the Bootstrap and Tara open pits, 84 acres of haul and access roads, 50 acres of exploration disturbance, and 1 acre for the communication site.
- The Blue Star/Genesis was acquired by Newmont in 1968 and open-pit mines began operations in 1974. In 1995, Newmont began mining the Deep Star underground deposit at the Blue Star/Genesis open pit. In 2010, expansion of the Genesis Project was approved, extending the mine life for an additional 12 years. The Genesis Project includes expansion of the Genesis open pit and backfilling several of the existing open pits with waste rock material.
- In 1988, Newmont constructed and began operation of the North Area Leach Facility and Mill No. 4. The North Area Leach Facility is utilized by Newmont to process leach grade ores from the North Operations Area. The life of the North Area Leach Facility was extended with the extension of Blue Star/Genesis open pit. In 2006, Mill No. 4 facilities were decommissioned and the disturbed area was transferred to BGMI.
- The Carlin Mine was the first modern day gold mine to be developed on the Carlin Trend. The Carlin Mine was discovered in 1962 and operations began in 1965 as an open-pit mining and milling operation. The Carlin Mine facilities include open-pit and underground mines, WRDFs, haul roads, the closed Mill 1 site, a tailings disposal facility, buildings undergoing demolition, and surface exploration. The Carlin Mill 1 was constructed in 1965 and operated until 1994. Mill 1 was fully decommissioned in 1998 leaving the office and shop buildings on the site. The office and shop buildings were fully decommissioned in 2011. Underground mining at the Carlin Mine began in 1995 and continues to date. The Pete project was initiated in 2003. The Pete project consists of two separate open pits (Pete and Crow open pits), haul roads, and the Pete WRDF. The Crow open pit was partially backfilled and reclaimed in 2008. Underground mining (Bajo Project) began in the Pete Pit in 2010 at the end of the Pete open-pit operation. The Pete open pit is being partially backfilled by the underground operation. The Pete WRDF was reclaimed concurrently during the mining operation and the final reclamation began in 2010, with

an expected completion date in 2011. Mining continues in the Carlin Pit with the waste rock material being utilized to partially backfill parts of the pit. Currently, the life of the Carlin Mine is approximately 5 years. Reclamation activities are projected to continue until the 2027.

- Newmont's Leeville Project, in the center of the North Operations Area, began mine development and operations in 2002 with a project mine life of 18 years. This underground gold mine is located approximately 8 miles southeast of the project area. Major project components include the underground mine with one hoist and one ventilation shaft and underground access; the mine dewatering system, including a water treatment facility and pipeline system to convey groundwater from the Leeville Mine to BGMI's water management facility; a WRDF; access and haul roads; shipment of ore to Newmont's Mill 6 facility in the South Operations Area; and ancillary support facilities.

South Operations Area

In 1969, Newmont discovered gold in their South Operations Area located approximately 6 miles northwest of the Interstate 80 (I-80) corridor. Open-pit mining began in 1981 and has expanded periodically. The South Operations Area includes the Gold Quarry, Mac, and Tusc open pits; Chukar underground mine; mine dewatering, water treatment, and water management system; WRDFs; tailings disposal facilities; and ancillary facilities. Newmont began underground mining at Chukar in 1995. Newmont continues to mine at Gold Quarry by both open pit and underground methods. With the approval of the South Operations Area Project Amendment in 2002, the projected life of the Gold Quarry Mine was extended by an estimated 9 years.

Rain Mine

Newmont acquired the Rain claims in the Carlin Trend south of the I-80 corridor in 1979 and conducted exploratory drilling in the early 1980s to define the gold reserves. These deposits, located approximately 40 miles from the project area, consist mainly of Emigrant, Gnome, Snow Peak, Southern Mineralized Zone, Rain Extension, Tess, NW Tess, and Saddle. Mining operations were initiated at the Rain property in 1987. Mining operations consisted of open-pit and underground mining, waste rock disposal, ore processing, a tailings disposal facility, heap leaching facility, and ancillary facilities. Open-pit mining at Rain continued through 1999. Rain underground operations began in 1996 and continued through 1998. Mining activity has ceased and the Rain Mine is currently undergoing reclamation and closure.

Emigrant Mine

Newmont's Emigrant open-pit mine project is located within 1 mile of the Rain Mine. BLM approved the Emigrant Mine project in January 2011, which includes plans for an open pit mine, a WRDF, a run-of-mine heap leach pad, and ancillary support facilities. The Emigrant Mine has an estimated operational life of 10 years for mining and 4 additional years of active leaching.

Ivanhoe Mining District Mines

The Ivanhoe Mining District is located at the north end of the Carlin Trend, approximately 7 miles northwest of the proposed project. Exploration and mining activities have been conducted in the Ivanhoe Mining District over the past 100 years, with the majority of activity occurring from 1980 to the present. The district has been actively explored for mercury, molybdenum, uranium, and gold. Several companies, including U.S. Steel Corporation, Touchstone Resources Corporation, Newmont Exploration Ltd, Rodeo Creek Gold (RCG), and Great Basin Gold Inc. have recently been involved with gold exploration. Recent past and present activities in the Ivanhoe Mining District are presented below.

- Newmont's Ivanhoe Mine, also known as the Hollister open-pit mine, is an open-pit operation undergoing reclamation and closure. The Ivanhoe/Hollister open-pit mine began operations in 1990 and ended mining in 1991. The mining of the Ivanhoe/Hollister open pit was operated by

Touchstone Resources. Newmont acquired the property in 1992 after mining was completed and began reclamation.

- The Hollister Development Block Project is an underground exploration project currently operated by RCG. Hecla Ventures began exploration in 2004 (BLM 2004a). RCG acquired Hecla's interest in 2008. The Hollister Development Block Project currently is dewatering from underground facilities and discharges up to 700 gallons per minute (gpm) to the Rock Creek hydrobasin (BLM 2007a,b).
- RCG also conducts surface exploration at the Ivanhoe/Hollister open-pit mine area under the Ivanhoe Exploration PoO.

In addition to precious metal mines, sand and gravel mines also operate in the Carlin Trend. Approximately 395 acres of private land have been disturbed by sand and gravel operations in the Carlin area (BLM 2012). Sand and gravel from these operations have been used to support construction and maintenance of area roads, such as I-80 and State Highway 766 (BLM 2010b).

3.2.1.2 Mineral Exploration

Exploration activities within the Carlin Trend include access road and drill pad construction, drilling, and trenching resulting in isolated areas of land disturbance. Exploration operations that disturb more than 5 acres of land surface require a PoO and are included in **Table 3.2-1**. Additionally, smaller exploration programs that require under 5 acres of surface disturbance (notice-level projects) occur in the Carlin Trend. Notice-level exploration programs expire every 2 years unless extended. Notices are closed once reclamation is complete.

3.2.1.3 Mine Dewatering and Discharge

The proposed project does not require mine dewatering; however, dewatering to facilitate other mining operations in the Carlin Trend has been ongoing in the vicinity for approximately 20 years. As mines have advanced to deeper levels, pump systems, dewatering wells, and associated discharge systems have been installed to lower the groundwater inflow to open pits and underground workings. BLM has evaluated dewatering and discharge activities in the Carlin Trend in recent documents that include EISs and specific cumulative analyses. BLM documents that provide detail on past and present mine dewatering and discharge activities related to the proposed project include the Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project (BLM 2000b); the Betze Pit Expansion Project, Final Supplemental EIS (BLM 2009), the South Operations Area Project Amendment Cumulative Effects, Final Supplemental EIS (BLM 2010a), and the Leeville Project, Final Supplemental EIS (BLM 2010b). Past and present mine dewatering and discharge activities are presented below.

- Maggie Creek Basin – Dewatering and discharge activities in the Maggie Creek Basin result from Newmont's South Operations Area mining operation. The South Operations Area mitigation plan currently is in place to address potential adverse impacts from dewatering. The Gold Quarry Mine currently pumps water at a rate of approximately 14,000 gpm for use in mine operations, occasional storage in Maggie Creek Reservoir, irrigation, and discharge directly to Maggie Creek and ultimately the Humboldt River.
- Boulder Flat Basin – Dewatering in the Boulder Creek area includes activities at BGMI's Betze pit and underground Meikle Mine (approximately 14,500 gpm). Dewatering is managed according to a water management plan for use in mine operations, storage in the TS Ranch reservoir, irrigation, the Boulder Valley reinjection system, the Sand Dune drainage and evaporation network, and discharge to the Humboldt River.
- Newmont's Leeville Project dewaters approximately 13,400 gpm for use in mine operations; the excess water is discharged into a pipe that is connected to BGMI's dewatering system, which is incorporated into BGMI's dewatering program and utilized or discharged accordingly.

- The Hollister Development Block exploration project has been permitted to pump water collected via gravity, drainage, and seepage in the underground decline. Groundwater entering the exploration decline (up to approximately 700 gpm) is pumped to the surface and into a recycle pond for storage, reuse and infiltration into alluvium near the confluence of Little Antelope Creek and Antelope Creek.

Groundwater levels in the proposed project area are expected to begin recovery when BGMI's dewatering program ceases at the end of mine life (estimated to occur in late 2021) (Schafer Limited LLC 2012a).

3.2.1.4 Ore Processing

Newmont and BGMI operate refractory ore processing mills at the Gold Quarry Mine and the BGMI facility, respectively. In refractory ore processing, heat is used to facilitate gold recovery by liberating sulfide minerals from refractory or sulfidic ore. Gold is then recovered by using standard cyanide extraction method (BLM 2010b).

3.2.1.5 Grazing and Agriculture

Livestock grazing has been one of the main land uses over many decades in the Carlin Trend area. Grazing allotments and/or fenced range exist within and around the project area. The number of animals allowed on allotments is periodically adjusted in response to mine development, drought, wildfires, and availability of stock water. Surface water and groundwater resources are used to support livestock grazing and production of alfalfa and native grass hay production (BLM 2010b).

3.2.1.6 Oil, Gas, and Geothermal Leases

Elko District competitive oil and gas lease sales are conducted annually. Lease areas are designated based on a nomination process involving interested parties. Once parcels of land have been nominated to the BLM state office for lease, the land parcel is placed on a competitive auction list for sale. Parcels located within the Carlin Trend or within the Elko District may be included on the list, however this is not known until the sale is scheduled. Until the sale is completed, it is not known as to whether or not any parcels located within the Carlin Trend or Elko District have been leased. Oil and gas leases are issued for a period of 10 years.

Leases for geothermal development have also been issued in the Carlin Trend area. Geothermal leases are nominated and placed on a competitive auction list for sale. It is not known where the lease parcels are located until the sale is scheduled. Additionally, it is not known as to whether or not a geothermal lease is issued until the sale is completed and the results are posted. Geothermal leases are issued for a period of 10 years.

3.2.1.7 Utilities

Several rights-of-way (ROWs) exist and are permitted to various entities. Surface disturbing activities associated with most of the ROW actions pertain to transmission lines and substations, water wells and pipelines, natural gas pipelines, fiber optic lines, communications sites, and access roads. The surface disturbance associated with the existing ROWs varies for each action. ROWs would continue to be issued in the future for activities that are developed, proposed, and required by regulation.

Present utility and community actions resulting in surface disturbance in the Cumulative Effects Study Areas (CESAs) include state, county, and public roads; the Ruby Pipeline; the TS Power Plant; Tuscarora Geothermal Power Plant; and development primarily associated with the communities of Carlin, Elko, Spring Creek, Battle Mountain, and Winnemucca.

The Ruby Pipeline, a 675-mile natural gas pipeline was completed in July 2011 and extends from southwest Wyoming, across Utah, Nevada, and terminates near the California-Oregon border. The pipeline route is located approximately 19 miles north of the Hollister Site and was constructed within a 115-foot-wide corridor.

The TS Power Plant, transmission lines, and associated facilities are located 3 miles north of Dunphy and approximately 30 miles south of the Hollister Site in Eureka County, Nevada. The TS Power Plant is owned by Newmont's subsidiary Newmont Nevada Energy Investment, LLC. This 242-megawatt capacity coal-fired power plant became operational in June 2008 and provides power for Newmont's mining operations throughout northeast Nevada. Excess annual capacity is made available to the NVEnergy Power Company. Approximately 600 acres of surface disturbance are associated with the TS Power Plant (BLM 2011a).

Ormat Technologies, Inc. (Ormat) has recently constructed the Tuscarora Geothermal Power Plant in Elko, Nevada north of Tuscarora, Nevada. The total surface disturbance for the power plant, access road, and power transmission line, is approximately 170 acres.

Surface disturbance has occurred within the Carlin Trend due to transmission line upgrades and ROWs that support ongoing mining activities and municipalities in Nevada, Idaho, and California. Although there are designated ROWs associated with transmission lines, the associated surface disturbance typically is minimal (e.g., restricted to the pole locations and maintenance access, as needed). A 345-kilovolt transmission line north of the proposed project transmits electricity from the Valmy Power plant to the Coyote substation and eventually supplies power to the states of Idaho and California. The existing 120-kilovolt transmission lines transmit electricity from the Falcon and Bell Creek substations to the Coyote substation (**Figure 3.2-2**) and mine substations, which are part of the power grid for the mines in the Carlin Trend.

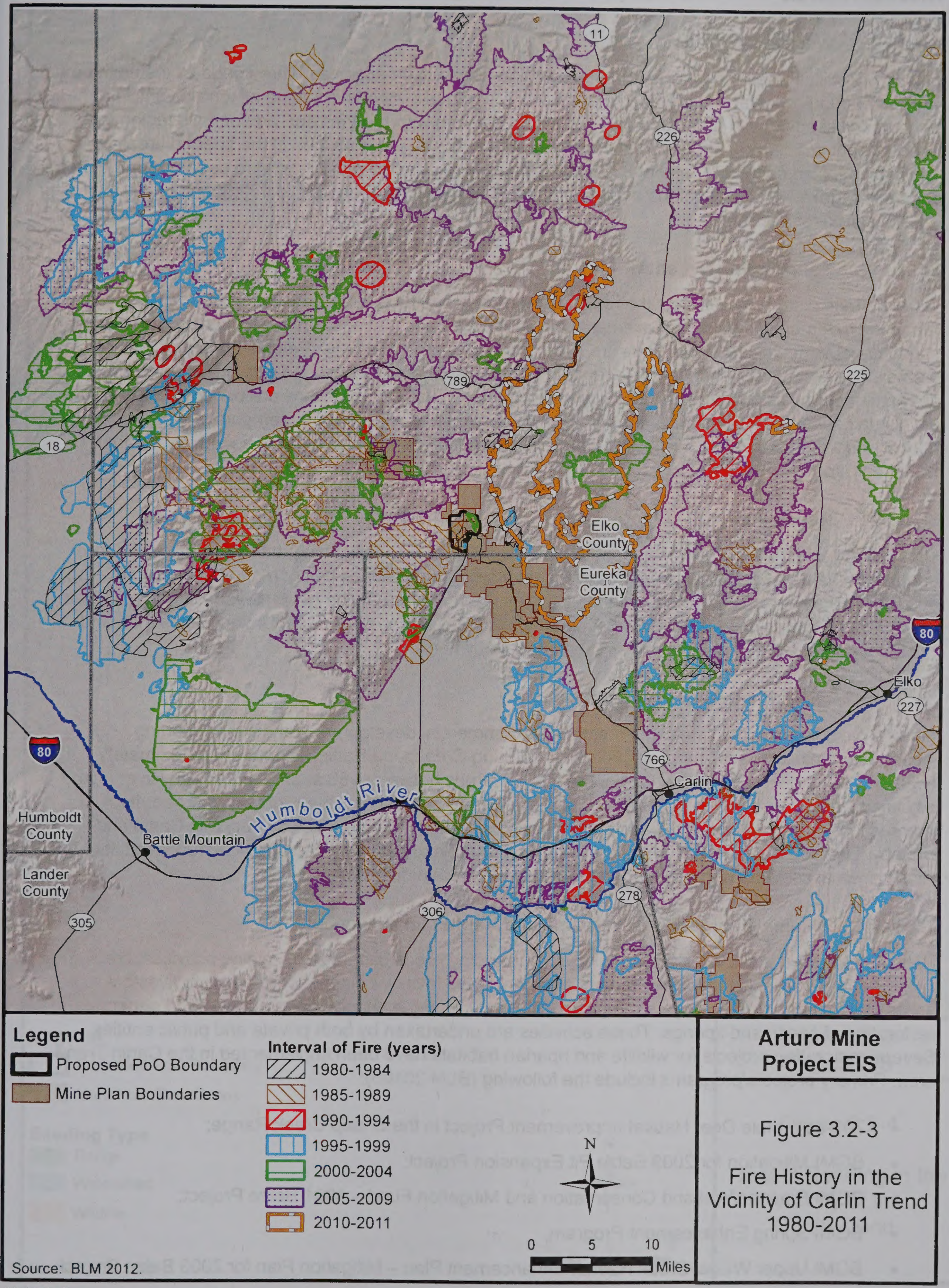
3.2.1.8 Fuel Reduction Program (Wildfire Prevention)

The BLM has a vegetation treatment program that reduces vegetation for wildfire suppression purposes. Fuel reduction programs within the Elko District consist of creating fuel (vegetation) breaks to help manage wildfires. Fuel breaks are changes in vegetation height and/or type. Fuel breaks may include, but are not limited to, mowing vegetation, planting greenstrips, controlled burns, and treatment of noxious weeds or non-native invasive plant species. Greenstrips are vegetation planted in strips with species that are more fire resistant because they stay greener longer during the dry summer months.

Fuel reduction is used around communities to help reduce damage to property from wildfires, create mosaic vegetation patterns for wildlife habitat, create varying vegetation age classes in vegetation communities in an attempt to prevent catastrophic wildfires, remove diseased vegetation, and attempt to eliminate noxious weeds or non-native invasive plant species such as cheatgrass.

3.2.1.9 Wildfires

Figure 3.2-3 illustrates the fire history in the vicinity of the Carlin Trend between 1980 and 2011. Approximately 47 percent (1.8 million acres) of the 3.9 million acres shown in **Figure 3.2-3** were impacted by fire during the past three decades. Wildfires may be started by lightening or human errors and range in size from less than 1 acre to large catastrophic fires encompassing hundreds or thousands of acres. Wildfire occurrence, sizes, and locations are unpredictable and may occur on lands within the CESAs any time when conditions are favorable.



Arturo Mine Project EIS

Figure 3.2-3

Fire History in the Vicinity of Carlin Trend 1980-2011

Source: BLM 2012.

5/16/2012

3.2.1.10 Wildfire Re-seeding

Figure 3.2-4 illustrates recent BLM re-seeding efforts on the burned areas. Three seed mixes have been used to support rangeland, watersheds, and wildlife. Various methods including all terrain vehicle and harrow, drill seeding with rangeland drill, broadcast seeding with broadcaster, and aerial seeding were used to plant grass, forb, and shrub species. Shrub plants also were planted in the seeded areas to establish a mixed canopy. A total of 330,100 acres were re-seeded with the wildfire seed mix in the area shown in **Figure 3.2-4**. Rangeland and watershed seed mixes were applied to 139,500 and 18,100 acres, respectively.

3.2.1.11 Range Improvements

Other surface disturbing activities that exist and may be constructed in the future within the CESAs are range improvements. Range improvements include fences and cattleguards; water systems consisting of spring developments, wells, pipelines, troughs, and ponds; and seedings. Fences are linear features that create small amounts of surface disturbance. Surface disturbance associated with water systems varies dependent upon the components of the specific project. Usually the pipelines are buried; therefore, the associated surface disturbance is temporary until the area has revegetated. Temporary exclusion fences may be installed for a few growing seasons while vegetation re-establishes after a wildfire, and then would be removed.

3.2.1.12 Recreation

Recreational use of land in and adjacent to the Carlin Trend includes fishing; hunting (deer, antelope, and upland game birds); sightseeing; cross-country skiing; horse-back riding; rock hounding; canoeing; and off-highway vehicle use. Recreational activities are managed by the BLM, Nevada Division of State Parks, United States Department of Agriculture-United States Forest Service, United States Fish and Wildlife Service, Bureau of Indian Affairs, and private owners.

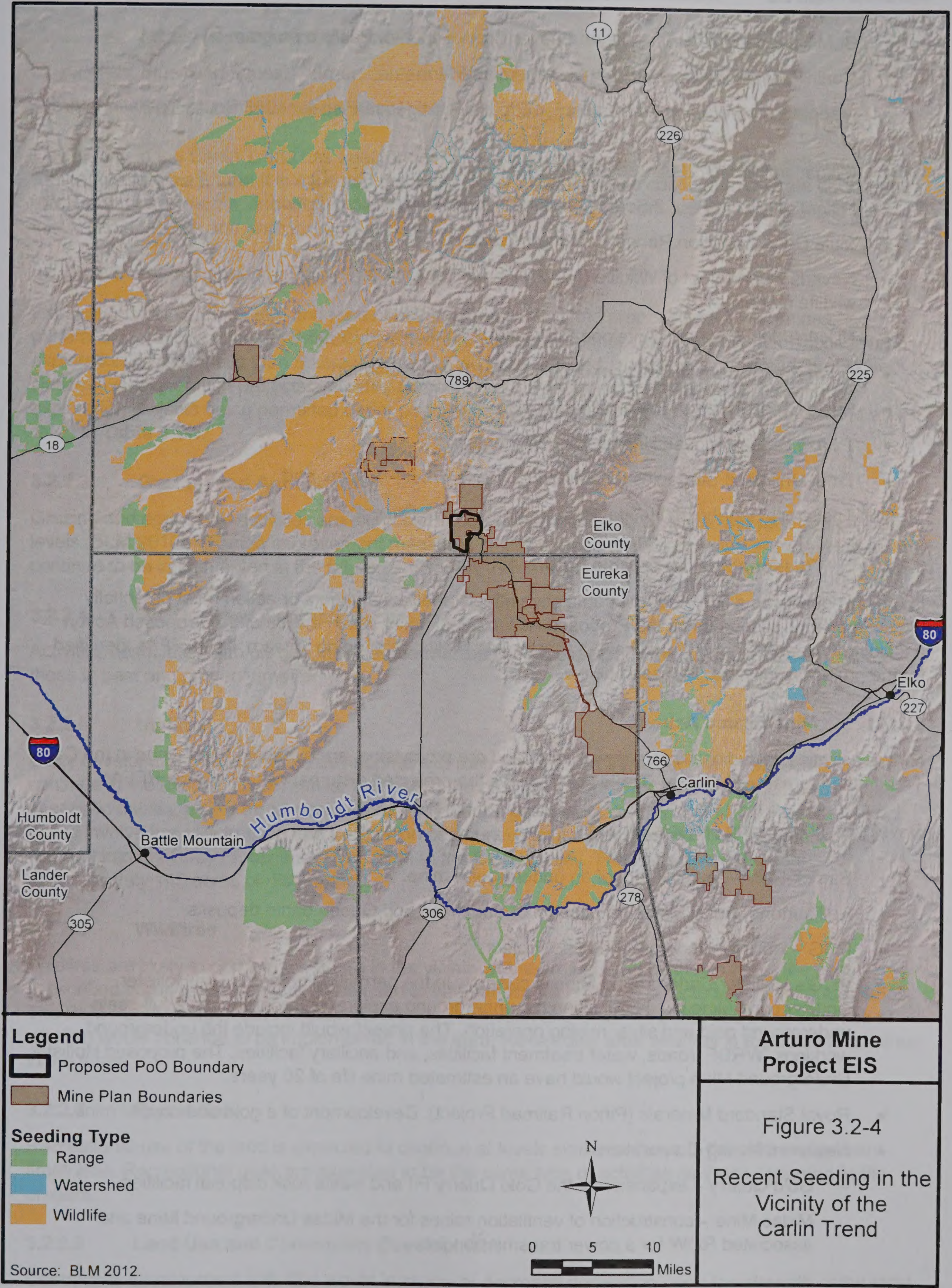
3.2.1.13 Land and Community Development

Surface disturbance associated with residences, commercial development, and the supporting infrastructure exists in the towns of Carlin, Elko, Spring Creek, and Battle Mountain. Approximately 565 acres have been platted for development in the areas between I-80 and the Humboldt River in and adjoining the Town of Carlin. Other development is occurring east of State Highway 766 near its intersection with I-80. Another 23 acres have been platted at Palisade, midway between Carlin and Dunphy. Development in the Dunphy area consists of approximately 6 acres (BLM 2010b). Additional disturbance associated with these communities has not been quantified.

3.2.1.14 Wildlife Management Programs and Habitat Improvements

Habitat restoration activities in the area include reseeding areas disturbed by mining activities, fire, livestock, or treatments for noxious weeds and non native invasive plant species; limiting livestock access to riparian areas through strategic fencing and grazing management practices; and general restoration of seeps and springs. These activities are undertaken by both private and public entities. Several restoration projects for wildlife and riparian habitats have been implemented in the Carlin Trend area. Primary projects/programs include the following (BLM 2010b):

- 709-acre Mule Deer Habitat Improvement Project in the Sheep Creek Range;
- BGMI Mitigation for 2009 Betze Pit Expansion Project;
- BGMI Riparian/Wetland Conservation and Mitigation Fund – 1991 Betze Project;
- BGMI Spring Enhancement Program;
- BGMI Upper Willow Creek Habitat Enhancement Plan – Mitigation Plan for 2003 Betze Project;



Source: BLM 2012.

Arturo Mine Project EIS

Figure 3.2-4

Recent Seeding in the Vicinity of the Carlin Trend

5/7/2012

- BLM/Nevada Mining Association Beaver Creek Riparian Pasture program.
- Carlin Trend Mule Deer Habitat Management Plan;
- Maggie Creek Watershed Restoration Project – Mitigation Plan for 1993 South Operations Area project;
- Mitigation Plan for 2002 Leeville Project;
- Mitigation Plan for 2002 South Operations Area Project Amendment;
- Mule Deer Transition Range Seeding Project;
- Nevada Department of Wildlife (NDOW) Industrial Artificial Pond Permit program to prevent wildlife mortality;
- NDOW Mule Deer and Antelope Population Management Programs;
- Open Range Consulting Lahontan Cutthroat Trout Evaluation;
- Susie Creek Riparian Restoration Project;
- T Lazy S Sage-grouse Habitat Improvements;
- Trout Unlimited Strategies for Restoring Native Trout Program; and
- Tuscarora Sagebrush Habitat Restoration Initiative Project.

3.2.2 Reasonably Foreseeable Future Actions

In order to qualify as a RFFA for the cumulative effects analysis a project or action must potentially impact the same resources as the Proposed Action, must occur within the life of the Proposed Action (including reclamation), and must have a reasonable likelihood of going forward. The RFFAs identified for the project vicinity are discussed below.

3.2.2.1 Mine-related Actions

Mining activities, including mining, dewatering, and ore processing, are expected to continue in the Carlin Trend in the foreseeable future. **Table 3.2-1** shows the projected disturbances for mining RFFAs.

Development of mining projects include:

- Barrick-Ren – development of an underground mine.
- Halliburton – Rossi Mine – expansion of Sage Hen and Queen barite deposits.
- RCG – Hollister Underground Mine Project.
- RCG's Hollister Underground Mine is currently in the permitting process. The Hollister Underground Mine would transition the underground exploration program into a full-scale underground gold and silver mining operation. The project would include the underground workings, WRDF, roads, water treatment facilities, and ancillary facilities. The proposed Hollister Underground Mine project would have an estimated mine life of 20 years.
- Royal Standard Minerals (Piñon Railroad Project). Development of a gold and copper mine.
- Newmont Mining Corporation:
    - Gold Quarry – expansion of the Gold Quarry Pit and waste rock disposal facilities.
    - Midas Mine – construction of ventilation raises for the Midas Underground Mine and associated ROW for a power transmission line.

- Mike – development of a gold mine.
- Blue Star/Genesis, Green Lantern Project, and expansion of the Lantern Pit.
- Carlin – continued expansion of the existing open pit.

Dewatering in the Carlin Trend has been ongoing for approximately 20 years and is expected to continue for the foreseeable future. It is expected that mine developments would continue to operate dewatering wells, pumping systems, and discharge systems to ensure mining can proceed without groundwater inflow into open pits and underground workings.

3.2.2.2 Exploration Activities

Exploration drilling, trenching, and road construction at current and proposed mine operations and mineral exploration projects would be expected to continue throughout the Carlin Trend. Notice-level exploration projects (less than 5 acres) are expected to be initiated, completed, reclaimed, and closed. Notice-level exploration projects are either completed or extended on a 2-year basis. New RFFA exploration projects being permitted under plans of operations that are located in the Carlin Trend are listed in **Table 3.2-1**.

3.2.2.3 Grazing and Agriculture

Grazing and agriculture activities are expected to continue in the future similar to the past and present levels (BLM 2010b). Range improvement measures create surface disturbance and are expected to continue to be implemented in the future.

3.2.2.4 Oil, Gas, and Geothermal Leases

Activities associated with oil, gas, and geothermal leases are expected to continue at levels similar to those in past and present timeframe.

3.2.2.5 Utilities

Utility development, including the development of road and support infrastructure, is expected to continue in the future at levels similar to those in the past and present timeframe. Utilities also include fiber optic cables, power transmission lines, and natural gas pipelines. The North Elko Pipeline Project would involve the construction and installation of a buried natural gas pipeline. This pipeline would connect into the Ruby Pipeline and run south to the BGMI facility. The Project would create approximately 140 acres of disturbance.

3.2.2.6 Wildfires

Wildfires are likely to occur in the future in the vicinity of the project area as they have in the past. Prescribed burns would continue to be used to help reduce fuel loads in selected areas on public lands. The BLM Fuel Management Program (to reduce vegetation and other fuels that could increase risk of wildfire) would continue to be implemented in the area. Re-seeding after wildfires is expected to continue in the future.

3.2.2.7 Recreation

Recreational use of the land is expected to continue at levels similar to those in the past and present timeframe. Recreational uses are expected to be the same type of activities as those occurring in the present.

3.2.2.8 Land Use and Community Development

Community development activities would increase or decrease depending upon the strength of the local economy, employment levels, and population in the communities of Carlin, Elko, Spring Creek, and

Battle Mountain. Development, both commercial and residential, is expected to continue to be commensurate with population and employment increases in the area.

3.2.2.9 Wildlife Management Programs and Habitat Improvements

Habitat restoration measures are anticipated to continue and perhaps increase in the future. Wildlife management programs and habitat improvements are expected to improve habitat for terrestrial and aquatic species, including threatened and endangered species and species of concern. Sage-grouse habitat restoration would continue in the project region through programs implemented by NDOW, BLM, and other organizations.

3.3 Geology and Minerals

3.3.1 Affected Environment

This section addresses the geology, mineralization, and geologic hazards associated with the proposed Arturo Mine project. The geologic conditions discussed below also provide the background information for characterizing the hydrogeologic setting and geochemistry provided in Section 3.4, Water Resources and Geochemistry.

The study area for geology and minerals includes the proposed Plan of Operations boundary. The Cumulative Effects Study Area (CESA) for geology and minerals resources includes the northern portion of the Carlin Trend (**Figure 3.3-1**). The Carlin Trend is a 38-mile-long north-northwest alignment of carbonate-hosted gold deposits (Teal and Jackson 2002). The CESA was defined to include the existing and planned mining activities within the northern portion of the Carlin Trend.

3.3.1.1 Physiographic and Topographic Setting

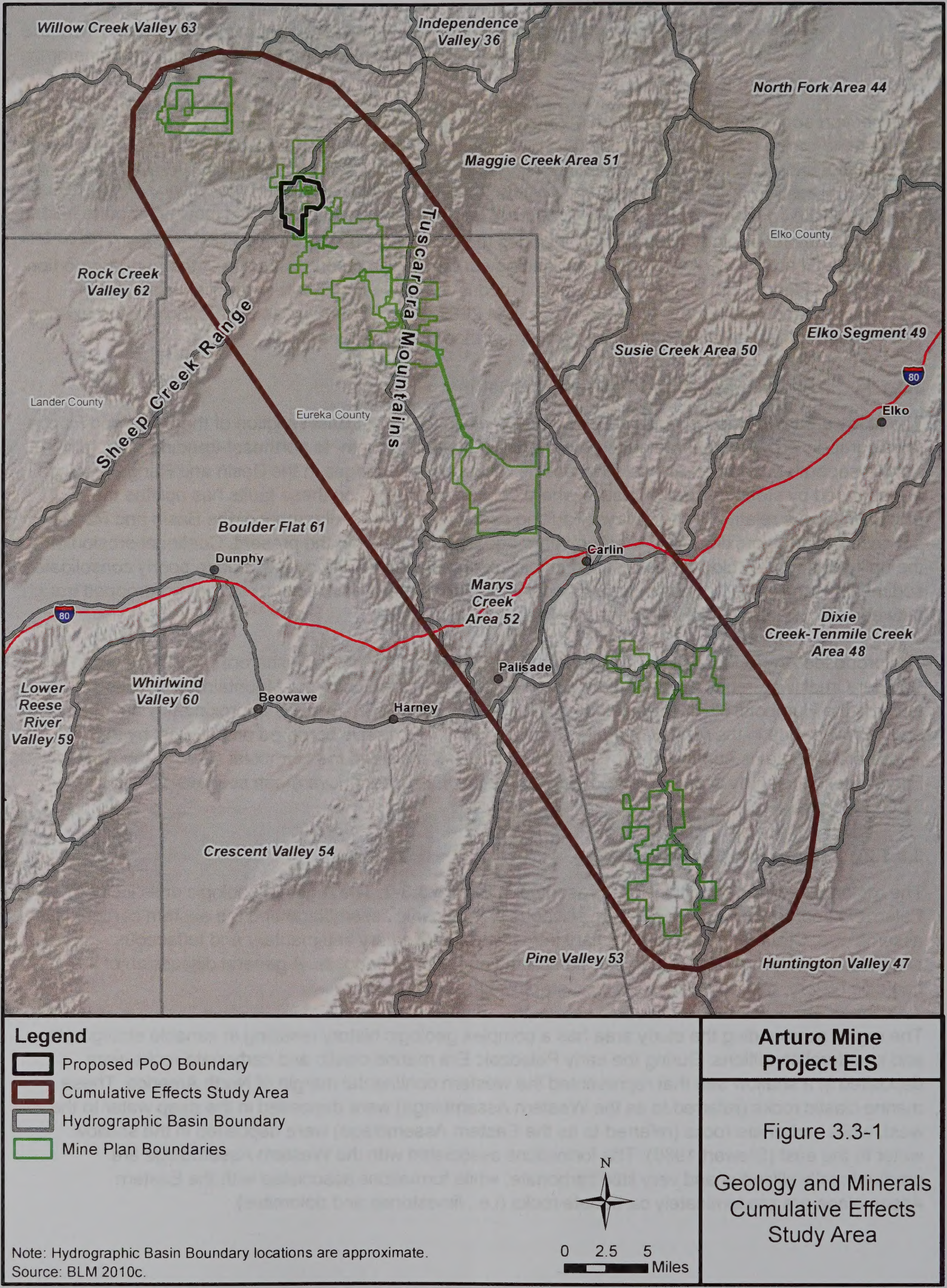
The study area is located in north-central Nevada within the Great Basin section of the Basin and Range physiographic province, characterized by a series of generally north- to northeast-trending mountain ranges separated by broad alluvial filled basins. The mountain ranges in the Basin and Range province are bounded by steep range-front faults where vertical movement on these faults has uplifted the mountain blocks relative to the valleys. Faulting associated with development of the Basin and Range province began approximately 14 million years ago and continues to the present. Continual erosion off the uplifted mountain blocks has resulted in thick accumulations of unconsolidated to poorly consolidated sediments in the valley (or basin) areas. Locally, Boulder Creek basin represents a down-dropped trough between the Sheep Creek Range and the Tuscarora Mountains.

The proposed Arturo Mine site is located along the western flank of the Tuscarora Mountains within the Boulder Creek watershed area. Boulder Creek originates in the Tuscarora Mountains and flows south towards the Humboldt River (**Figure 3.3-1**). Overall, Boulder Creek Basin is approximately 20 miles long and 15 miles wide in the vicinity of the Humboldt River. The basin is bordered on the west by the Tuscarora Mountains and the east by the Sheep Creek Range and the Humboldt River to the South. Elevations in the study area range from approximately 5,200 feet above mean sea level (amsl) to 6,100 feet amsl.

3.3.1.2 Regional Geologic Setting

The regional geologic conditions are presented in **Figure 3.3-2**. The regional geologic units include Paleozoic bedrock units of the western siliceous and volcanic assemblage and the eastern carbonate assemblage, Cretaceous through Tertiary intrusive rocks, Tertiary sedimentary and tuffaceous sedimentary rocks and Quaternary fanglomerates and alluvial deposits. A general discussion of the geologic history, geologic units, and stratigraphy is presented below.

The region surrounding the study area has a complex geologic history resulting in variable stratigraphic and structural conditions. During the early Paleozoic Era marine clastic and carbonate rocks were deposited in a shallow sea that represented the western continental margin of North America. These marine clastic rocks (referred to as the Western Assemblage) were deposited in the deep water to the west, while carbonate rocks (referred to as the Eastern Assemblage) were deposited in the shallow water to the east (Stewart 1980). The formations associated with the Western Assemblage are predominantly siliceous and very little carbonate, while formations associated with the Eastern Assemblage are predominately carbonate rocks (i.e., limestones and dolomites).



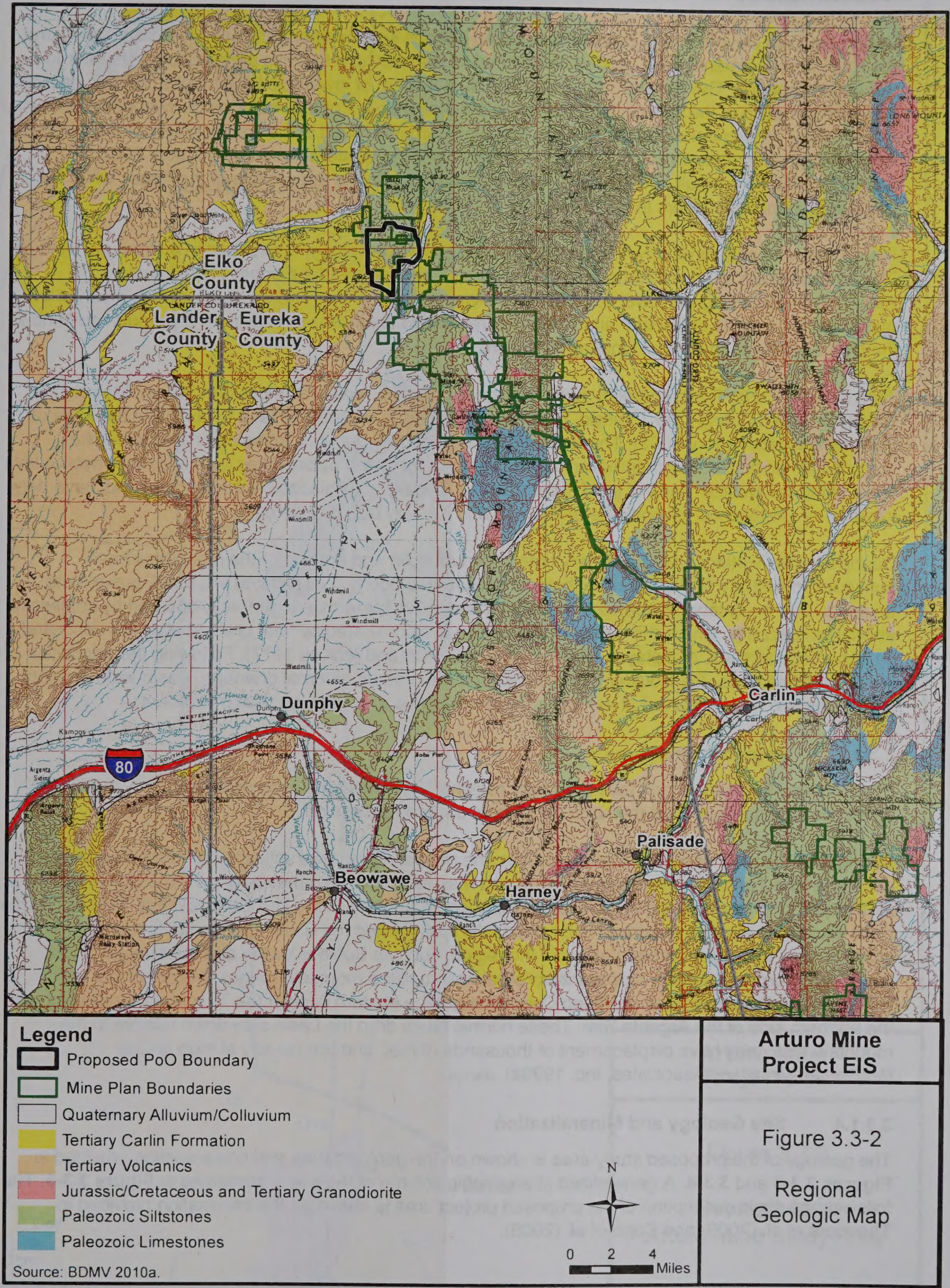
Arturo Mine Project EIS

Figure 3.3-1

Geology and Minerals Cumulative Effects Study Area

Note: Hydrographic Basin Boundary locations are approximate.
Source: BLM 2010c.

05/25/2012



Source: BDMV 2010a.

Arturo Mine Project EIS

Figure 3.3-2

Regional Geologic Map

05/30/2012

During the Late Devonian and Early Mississippian periods sedimentary deposition was interrupted and the Paleozoic sediments were uplifted, folded and faulted during a tectonic period geologists refer to as the Antler Orogeny. The Roberts Mountains Thrust, a system of low-angle thrust faults that has caused major deformation of the Paleozoic rocks, is the main expression of the Antler orogeny apparent in the region today. Movement along the Roberts Mountain thrust resulted in the displacement of the Western Assemblage up to approximately 90 miles eastward over the Eastern Assemblage (Jory 2002; Stewart 1980). As a result, the Western Assemblage occurs in the upper plate of the thrust, while the Eastern Assemblage occurs in the lower plate of the thrust.

In the proposed project vicinity, the lower plate (Eastern Assemblage) is exposed in a structural window. The window refers to an area where uplift and erosion has removed the upper plate (Western Assemblage) exposing the lower plate (Eastern Assemblage) rocks. The window includes much of the upper drainage areas of Boulder and Antelope creeks and extends generally from the Bootstrap Mine to the Dee Gold Mine and Storm Underground mines.

The northern Carlin Trend contains numerous igneous rocks, mostly as stocks and dikes. Magmatic activity occurred during Late Jurassic, Eocene, and Miocene events that tend to constrain the ages of gold mineralization (Jory 2002). These events include the late Jurassic intrusion of the Goldstrike granodiorite stock, Eocene magmatism consisting of rhyolite and dacite dikes, and Miocene rhyolitic lava flows along the western flank of the Tuscarora Spur. Locally the Paleozoic sedimentary rocks have been intruded by Cretaceous granodiorite and diorite and Tertiary quartz latite dikes.

During the late Tertiary and Quaternary time continual uplift and erosion of the mountains have continued to partially fill the basins with unconsolidated to poorly consolidated silt, sand, gravel, and boulders. The boundary between the mountains and valley margins are generally covered by coalescing alluvial fan deposits, where the center of the valleys are dominated by finer grained alluvium deposited by ephemeral streams and playas (Stewart 1980; Stewart and McKee 1977). Following the deposition of the basin fill deposits, the Boulder Basin developed the present external drainage. Basin-wide erosion and deposition have occurred at variable rates in response to continuing fault movements.

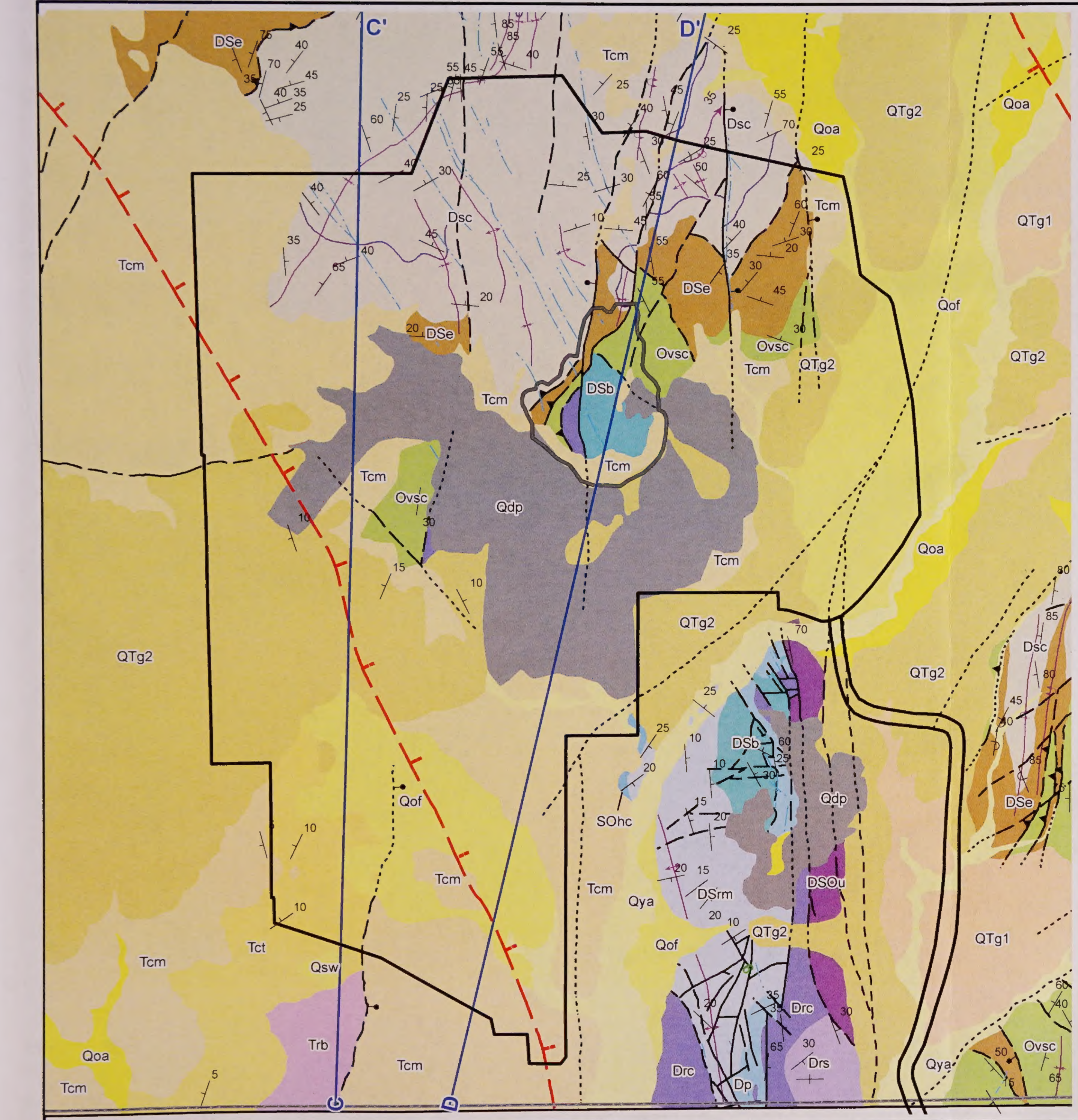
3.3.1.3 Regional Structures

The Roberts Mountains thrust fault is a major regional low-angle fault zone discussed previously. The fault zone dips gently toward the north throughout the project region.

During the Mesozoic and Early Cenozoic Eras, the project region was subjected to compression that resulted in the Tuscarora Mountain Anticline and may have fractured the rocks (of the anticline) providing pathways for mineral-bearing fluids and groundwater. Beginning in the late Cenozoic Era, the region was block-faulted by a series of normal and listric faults that created the Basin and Range topography that characterizes the region. Broad valleys in the region, such as Boulder Valley and the Maggie Creek basin, were formed as down-dropped blocks between uplifted mountain ranges. Major normal faults bound the southeastern flank of Sheep Creek Range, the eastern flank of the Tuscarora Mountains, and the northern side of the Argenta Rim. These normal faults drop the basin side down relative to the mountain side, may have displacement of thousands of feet, and are usually at high angles (McDonald Morrissey Associates, Inc. 1996a).

3.3.1.4 Site Geology and Mineralization

The geology of the proposed study area is shown on the geologic map and cross-section provided in **Figures 3.3-3** and **3.3-4**. A generalized stratigraphic column of the site is presented in **Figure 3.3-5**. The following geologic description of the proposed project area is based on the information provided in Theodore et al. (2006) and Cope et al. (2008).



Legend

- ☐ Proposed PoO Boundary
- ☐ Existing Pit
- — Cross-section

Geologic Units

Qdp	Waste dumps, tailings, and other mine-related cover

Unconsolidated Sediments (Quaternary)

Qya	Younger alluvium and fanglomerate
Qsw	Slope wash
Qoa	Older alluvium
Qof	Older fanglomerate
QTg1	Younger gravel deposits
QTg2	Older gravel deposits

Bedrock Units

Carlin Formation (Miocene)

Tcm	Silt, sand, and mudstone with tuff
Tct	Welded tuff, silt, and tuffaceous sandstone
Trb	Rhyolite of Boulder Creek

Upper Plate Rock Units (Paleozoic)

Dsc	Slaven Chert (Devonian)
DSe	Elder Sandstone (Silurian and Devonian)
Ovsc	Vinini Formation (Ordovician)
DSOu	Siliceous rocks undivided (Ordovician to Devonian)

Lower Plate Rock Units (Paleozoic)

Rodeo Creek Unit

Drs	Silty limestone
Drc	Chert
Dp	Popovich Formation (Devonian)

Calcareous Units

DSb	Bootstrap Limestone
DSm	Roberts Mountains Formation (Undivided)
SOhc	Hanson Creek Formation (Ordovician and Silurian)

Map Symbols

Bedding Strike and dip.

Dikes

55 90 Fault, normal and high angle reverse, and strike slip.

70 Thrust Fault

Approximate outer limit of the Carlin trend of gold deposits

Folds

Anticline

Syncline

Overturned syncline

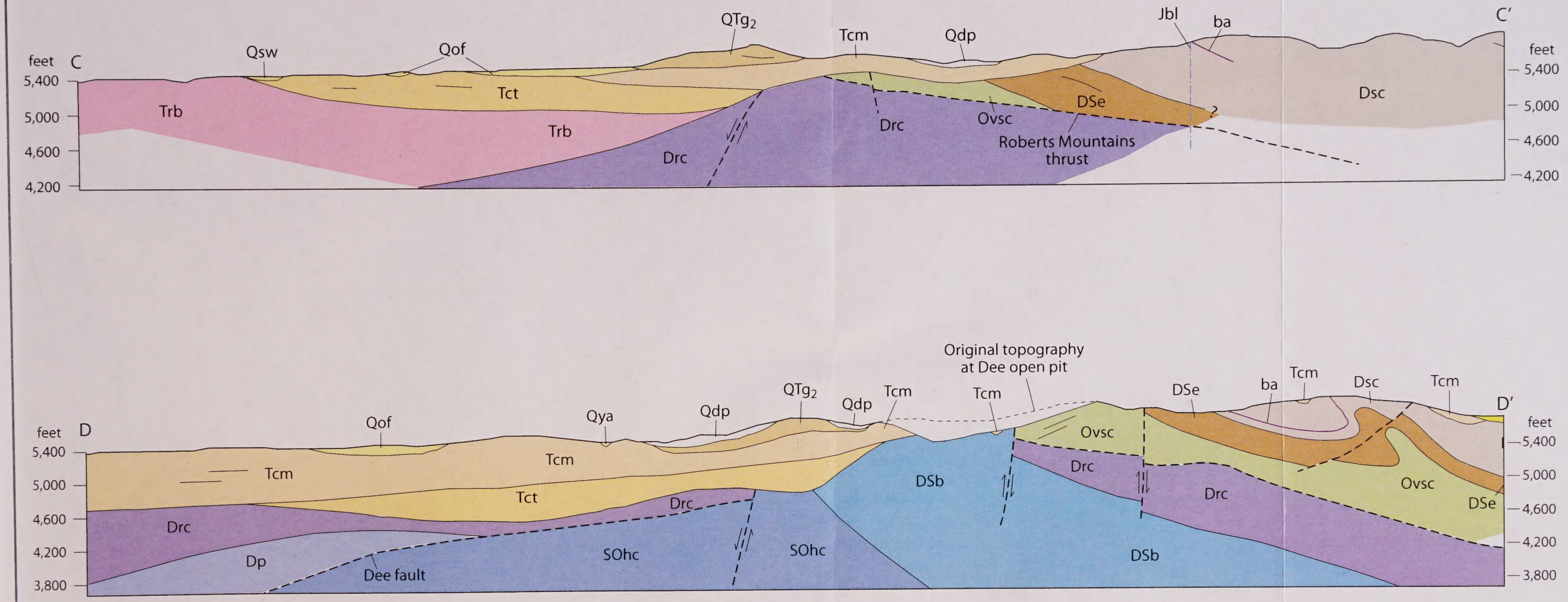
Overturned anticline

Source: Theodore et al. 2006.

Arturo Mine Project EIS

Figure 3.3-3

Geologic Map
Arturo Mine Study Area

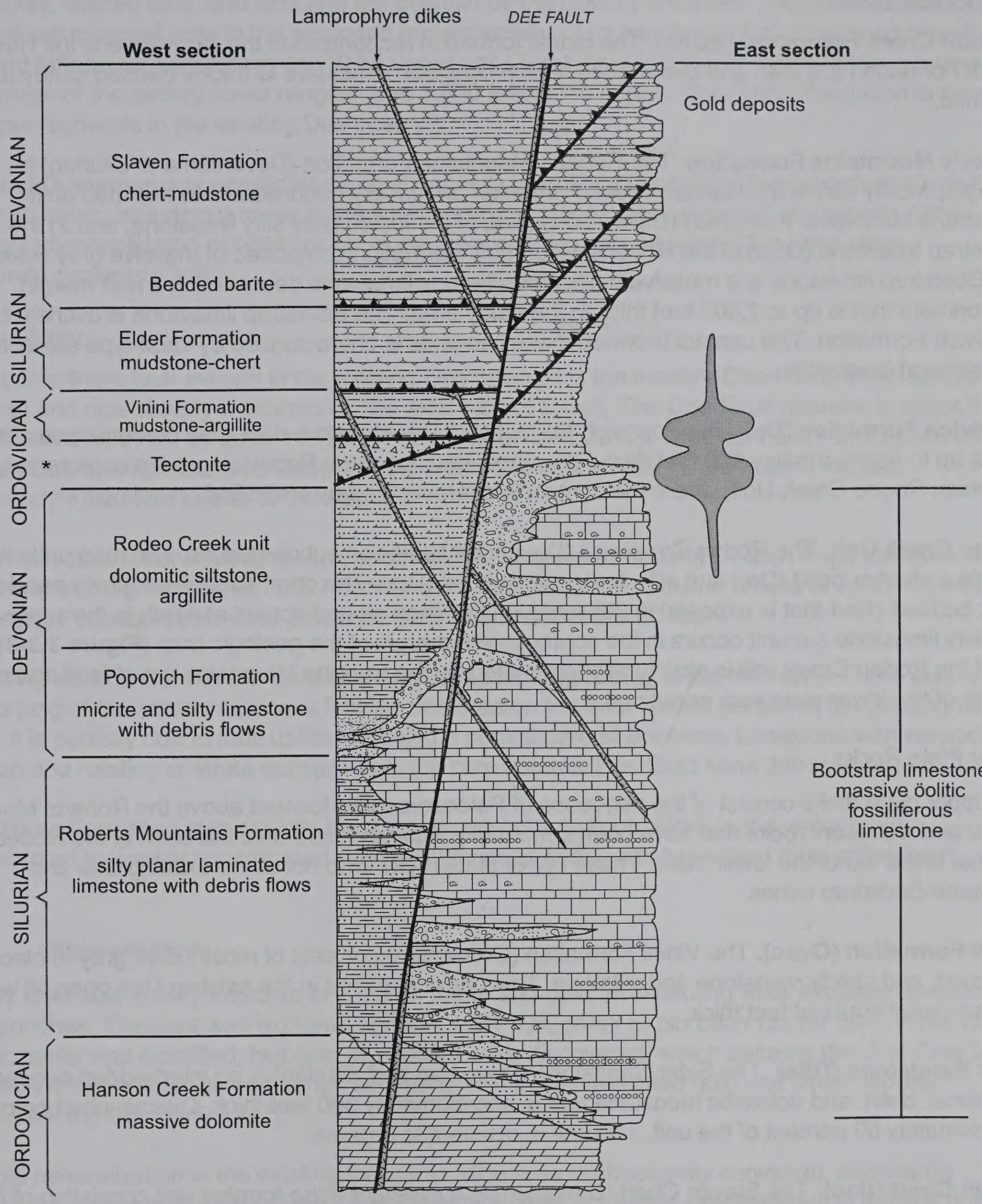


Arturo Mine Project EIS

Figure 3.3-4

Geologic Cross-sections
Arturo Mine Study Area

Note: See **Figure 3.3-3** for location of cross-sections and key.
Source: Theodore et al. 2006.



Legend

* Roberts Mountains Thrust

Arturo Mine Project EIS

Figure 3.3-5

Stratigraphic Column of Paleozoic Sequence

Source: Dobak et al. 2002.

06/15/2011

Lower Plate Rocks

Hanson Creek Formation (SOhc). The oldest formation recognized in the study area is the Hanson Creek Formation (Silurian and Ordovician), which consists of massive to thickly bedded sandy and silty dolomite.

Roberts Mountains Formation. The Roberts Mountains Formation (Devonian and Silurian) is stratigraphically above the Hanson Creek Formation and locally subdivided into two map units: 1) Roberts Mountains Formation (DSrm) consisting of laminated gray silty limestone; and 2) the Bootstrap limestone (DSb) of the Roberts Mountains Formation composed of massive gray limestone. The Bootstrap limestone is a massive oolitic, fossiliferous limestone deposited in a reef margin environment that is up to 2,000 feet thick in the study area. The Bootstrap limestone is overlain by the Popovich Formation. The contact between these two units is characterized by karst-type solution features and brecciation.

Popovich Formation (Dp). The Popovich Formation (Devonian) is a dark gray carbonaceous limestone that is up to approximately 100 feet thick. The upper contact of the Popovich grades conformably to the Devonian Rodeo Creek Unit, where the contact is characterized by a silicified breccia zone.

Rodeo Creek Unit. The Rodeo Creek unit (Devonian) has been subdivided into two map units that include a chert subunit (Drc) and silty limestone subunit (Drs). The chert subunit generally consists of black bedded chert that is exposed in the existing Dee open pit and occurs at depth in the study area. The silty limestone subunit occurs in the southeastern margin of the geologic map (**Figure 3.3-3**). The top of the Rodeo Creek unit is structurally terminated by the Roberts Mountains thrust fault and marks the top of the lower plate rock sequence.

Upper Plate Rocks

The upper plate rocks consist of the sequence of Paleozoic rocks located above the Roberts Mountain Thrust and represent rocks that have been structurally superimposed onto the chert of the Rodeo Creek unit that is the top of the lower plate. These upper plate rocks crop out at the existing Dee and Capstone-Bootstrap mines.

Vinini Formation (Ovsc). The Vinini Formation (Ordovician) consists of mostly dark gray to black shale and chert, and cherty mudstone and siltstone. This unit is exposed in the existing Dee open pit where the unit is several hundred feet thick.

Elder Sandstone (DSe). The Elder Sandstone (Devonian and Silurian) is an interbedded sequence of mudstone, chert, and dolomitic mudstone that is approximately 300 feet thick. Overall, chert comprises approximately 50 percent of the unit. The unit is resistant to erosion.

Slaven Chert (Dsc). The Slaven Chert (Devonian) is a resistant ridge-forming unit consisting of thin bedded variable colored chert with approximately 5 percent shale.

Intrusive Rocks

At least two generations of dikes have been recognized in the study area. The most notable zone of diking is a 1-mile-wide north-northwest trending zone with lamprophyre dike (Jbl) swarms, which includes the Arturo dike that has been dated as Jurassic. A diorite dike (TJd) from the footwall of the Dee fault in the existing Dee open pit was dated as Eocene (whole rock 40Ar/39Ar age date of 37.6 Ma) (Theodore et al. 2006).

Tertiary and Quaternary Units

Tertiary volcanic rocks and Carlin Formation sediments cover the Paleozoic bedrock over approximately 75 percent of the study area. The volcanic rocks (Trb) are reddish brown, pink to gray and include rhyolitic flows, welded tuffs, and tuffs and are overlain by the Carlin Formation. The Carlin Formation consists of two mapped units in the proposed project vicinity: 1) a basal unit (Tct) composed of welded tuff, silt and tuffaceous sandstone; and 2) an upper unit (Tcm) that includes silt, sand, and mudstone. The thickness of the tertiary cover ranges up to 1,800 feet in the region. The Carlin Formation is exposed in the upper highwalls in the existing Dee open pit.

Tertiary and Quaternary unconsolidated gravel deposits (Qtg2 and Qtg1) form flat-lying deposits that cover broad areas, including a mesa in the southwestern portion of the proposed project site. Other Quaternary unconsolidated deposits occur in the area include older alluvium (Qoa) and older fanglomerate deposits (Qof).

Local Structures

The most prominent fault evident in the existing Dee open pit is the inactive Dee Fault, which strikes north-south and dips steeply westward on the west side of the pit. The Dee Fault appears to offset the Roberts Mountains thrust by up to 100 feet (Piteau Associates 2010). The Ben Fault occurs just east of the current Dee open pit and dips steeply to the west. The sub-vertical Hinge Fault is located approximately 1,500 feet farther to the east.

The northeast-southwest striking, steeply southeast-dipping North Boulder Graben Fault transects the southern end of the proposed pit. The North Graben Fault appears to define offsets of up to 600 feet in the Bootstrap Formation below the proposed pit (Piteau Associates 2010).

Minor folding associated with the faulting is expressed as drag folding along the faults. There also is a broad warping of the strata in a domal fashion centered on the east-central portion of the existing Dee open pit. It is partially due to fault uplifts exposing a central core of Bootstrap Limestone with respective down-drop and rotating of strata outward from the core (Glamis Dee Gold Mine 2001).

The Bootstrap Formation also exhibits karst topography due to fluctuations in the water table. Unconsolidated to weakly consolidated Tertiary tuffaceous sediments have filled most of the karst features.

3.3.1.5 Mineralization

The study area was initially explored in 1975 for barite and gold. Prospecting work exposed barite in several trenches. The area was explored again in 1981 by Cordex Exploration Co. for gold. While no economic barite was identified, two gold ore bodies were discovered, which became the Dee Gold Mine. In general, the ore body is an epithermal sediment- and intrusive-hosted gold and silver deposit (Dee Gold Mining Company 1997).

Oxide gold mineralization in the existing Dee Gold Mine area is structurally controlled, dominantly paralleling the north-south striking Dee Fault Zone. Gold was emplaced simultaneous to several pulses of silica alteration, which converted mineralized wall rocks into massive silica or silica breccia. Enriched zones are found where the Dee Fault zone intersects northwest trending faults. Minor gold mineralization can be traced along northwest, northeast, and east-west structures trending away from the Dee Fault zone.

In the vicinity of the proposed South Arturo open pit, gold mineralization occurs as a breccia-hosted, oxide deposit. Mineralization is located within the breccia at the upper contact of the Bootstrap Formation. In the area comprising the Storm deposit, gold mineralization occurs as crosscutting and replacement-type silica-sulfide breccia.

3.3.1.6 Faulting and Seismicity

Faulting

The study area is located in a region that is characterized by active and potentially active faults. For the purpose of this assessment, an active fault is defined as a fault that shows evidence of displacement during the Holocene period (last 10,000 years), and a potentially active fault is a fault that shows evidence of surface displacement during the late Quaternary period (last 150,000 years). Surface fault rupture typically occurs along active fault traces.

Historically, surface displacement along faults occurred in Nevada during major earthquakes (i.e., Richter Magnitude >6.0) in 1869, 1903, 1915, 1932, and three events in 1954 (Stewart 1980). All of these events occurred along a north-trending zone called the Nevada Seismic Belt located southwest of the study area.

Active and potentially active faults that have been identified in the vicinity of the study area are listed in **Table 3.3-1**. The nearest potentially active fault to the site is a short (1-mile-long) fault segment located approximately 1.5 miles west of the site identified by the United States Geological Survey (USGS) as the "unnamed fault south of Santa Renia Mountains" (USGS 2012). This fault trends north-northeast and displaces Quaternary-Tertiary alluvium.

Table 3.3-1 Active and Potentially Active Faults in the Region

Fault Name	Length (miles)	Time of Most Recent Deformation	Approximate Distance from the Project Site (miles)
Unnamed fault south of Santa Renia Mountains	1	Quaternary (<1.6 Ma)	1.5
Southeast Sheep Creek Range Fault	28	Late Quaternary (<130 Ka)	3
Eastern Tuscarora Fault Zone	42	Quaternary (<1.6 Ma)	8
Shoshone Range Fault Zone	71	Latest Quaternary (<15 Ka)	11
Tuscarora Fault Zone	31	Quaternary (<1.6 Ma)	16
Eastern Independence Valley Fault Zone	25	Late Quaternary (<130 Ka)	18

Note: Ka = thousand years; Ma = million years.
Source: USGS 2012.

The northernmost mapped trace of the Southeast Sheep Creek Range fault is located approximately 3 miles southwest of the project area. The Southeast Sheep Creek Range fault is a major range front structure that bounds the southeast margin of the Sheep Creek Range and northwest margin of Boulder Valley. The fault has displaced Quaternary alluvium against Tertiary volcanic rocks.

The Eastern Tuscarora fault zone is located approximately 8 miles east of the project area. This fault zone is defined as a north-northeast trending fault that bounds the east margin of the Tuscarora Mountains. Movement along the fault has displaced Quaternary and Quaternary-Tertiary alluvium against Paleozoic bedrock.

The Shoshone Range fault zone is a set of northeast trending fault segments that forms the Western margin of the Shoshone Range and extends approximately 71 miles. The northernmost mapped trace of this fault zone is located in Boulder Flat approximately 11 miles south of the project area in Boulder Flat. The latest surface faulting event for this fault is probably during the Holocene (last 10,000 years) (USGS 2012). The Shoshone Range fault is the closest active fault system to the site. This fault system is estimated to be capable of producing a maximum credible earthquake of magnitude 7.2 (Sergent, Hauskins & Beckwith Consulting Engineers 1991).

Other potentially active fault zones in the region include the Tuscarora fault zone and East Independence Valley fault zone located 16 and 18 miles northeast of the site, respectively. These northeast trending fault zones displace early to middle Pleistocene sediments.

Seismicity

The study area is located in a region that has experienced seismic activity in historic time. Earthquake records indicate that nine earthquake events with a Richter Magnitude of 5 or greater have been recorded (USGS 2010) within an approximate 100-mile radius of the study area between 1901 and 2010. As shown in **Table 3.3-2**, the largest recorded earthquake to occur near the study area had a magnitude of 5.8. This earthquake occurred August 3, 1916, approximately 32 miles from the study area.

The closest recorded earthquake to the study area was an earthquake of magnitude 4.7 on September 18, 1945, approximately 1.2 miles from the project site (USGS 2010).

Table 3.3-2 Recorded Earthquakes with Richter Magnitude of 5.0 or Greater Located Within 100-mile Radius of the Proposed Mine Site

Year	Month/Day	Location (latitude, longitude)	Approximate Distance from Site (miles)	Estimated Magnitude
1901	7/26	40.80 – 115.70	41	5.0
1916	8/03	41.50 – 116.50	32	5.6
1916	8/03	41.50 – 116.50	32	5.8
1916	8/04	41.50 – 117.00	44	5.0
1916	10/11	41.50 – 116.50	32	5.0
1945	9/18	40.60 – 116.50	30	5.1
1946	1/15	40.50 – 117.25	56	5.1
1966	10/22	40.60 – 116.30	30	5.1
1968	7/06	41.10 – 117.40	81	5.5

Source: USGS 2010.

3.3.2 Environmental Consequences

Primary issues related to geology and minerals include: 1) geologic hazards created or exacerbated by development of the proposed project; 2) damage to critical facilities caused by seismically induced ground shaking; and 3) exclusion of future mineral resource availability caused by the placement of facilities (i.e., tailings, heap leach pad, or waste rock disposal facilities). Impacts associated with leaching or acid production from rocks stored in facilities on site or exposed in the pit walls are addressed in Section 3.4, Water Resources and Geochemistry.

3.3.2.1 Proposed Action

Direct impacts on geologic and mineral resources from the proposed project would include: 1) the generation and permanent disposal of approximately 600 million tons (MT) of waste rock and 64 MT of spent ore material (includes 50 MT stored on the proposed heap leach facility and 14 MT transported and stored in one or more tailings disposal facilities at the Barrick Goldstrike Mines Inc. (BGMI) facility; and 2) the mining of proven and probable ore reserves of approximately 2.2 million ounces of gold and 10.6 million ounces of silver.

The proposed project would result in an estimated total disturbance of approximately 2,774 acres. Open-pit mining disturbance (601 acres), and construction of the Waste Rock Disposal Facilities (WRDFs) (1,296 acres) and heap leach pad (226 acres) would permanently alter the natural topographic and geomorphic features over approximately 2,123 acres. The open pit would not be reclaimed; the WRDFs and heap leach pad would be reclaimed but would alter the topography and geomorphology of the study area. Other temporary facilities (e.g., stockpiles, process facilities, ancillary facilities, and haul roads) would be reclaimed to the approximate pre-mining topography and therefore would not permanently alter the natural topography and geomorphic features in the study area.

Geologic Hazards and Geotechnical Considerations

Geotechnical considerations include potential slope failures of the pit walls, WRDFs, or heap leach facility under static and earthquake loads, and settlement and ground deformation of foundation materials for the WRDFs and heap leach facility and related process ponds.

Pit Slopes

The proposed project includes deepening and expanding of the existing Dee open pit and development of three pit lobes referred to as the North Pit, South Pit, and East Pit (Section 2.3.2, Open Pit). The maximum depth of the pit lobes would range from approximately 965 to 1,020 feet, with a bottom elevation ranging from 4,730 to 4,910 feet amsl (SRK Consulting [U.S.] Inc. 2012). The pit design would include a 100-foot-wide pit adjustment zone around portions of the pit rim to provide operational flexibility.

Open-pit mines can experience periodic slope instability problems due to weak geologic materials; adversely oriented geologic structures, such as bedding, faults, and jointing; and groundwater presence. Ground movement caused by seismic events can trigger failure of slopes that are marginally stable under static conditions. Impacts associated with potential instability of the pit walls during operation and post-closure are discussed below.

Major rock units that would be exposed in the pit walls include the Bootstrap limestone, Rodeo Creek Unit, breccia unit, Vinini Formation, and Carlin Formation. All of these units, except the Carlin Formation, are typical bedrock units where the slope stability of these materials primarily is controlled by the orientation and physical characteristics of discontinuities within the rock mass (i.e., joint sets and faults). The Carlin Formation differs from the other bedrock units in that it contains weak high plasticity clay beds.

Dewatering activities at the BGMI facility have lowered the regional groundwater elevation to below the final elevation of the proposed pit. As a result, most bedrock units in the pit are fully drained (dry) to an elevation below the planned depth of the proposed pit (Piteau Associates 2008). Localized perched groundwater zones occur within the clayey strata of the Carlin Formation (Piteau Associates 2008). The occurrence of the groundwater appears to be controlled by groundwater that accumulates on top of lens or beds of clay within the Carlin Formation. Depressurization in the Carlin would likely be required to increase wall stability in the Carlin Formation. Typical methods used to depressurize localized perched zones include the installation of dewatering wells, passive vertical drains, and horizontal drains.

The final pit design would be developed prior to initiation of mining and modified as necessary as mining progresses and the actual geologic conditions and pit wall performance are verified. Piteau Associates developed preliminary feasibility-level slope design recommendations for the North and South Pit (Piteau Associates 2008), and East Pit (Piteau Associates 2010) based on the results of geotechnical data collection, laboratory testing, and slope stability analysis. Piteau Associates provided a review of the updated mine plan to verify that the pit design conforms to the slope design recommendations provided in the earlier reports and provided recommendations for minimum setback behind the ultimate pit crest (Piteau Associates 2011).

Slope design recommendations were developed to satisfy a minimum static factor of safety of approximately 1.2 or greater for all of the pit slopes (Piteau Associates 2011, 2010, 2008). A factor of safety is used to provide a design margin to ensure that a slope is stable and would not experience large scale slumping or sliding. (A computed factor of safety greater than 1 implies that the slope would be stable and is strong enough to support the assumed design loads.)

Piteau Associates also recommend a minimal setback distance of 130 feet from the ultimate crest of the pit for all pit slopes. Piteau Associates review of the current pit configuration included under the Proposed Action mine plan indicated that the mine plan is adequate to meet their feasibility slope design criteria (Piteau Associates 2011). Therefore, deepening and expanding of the open pit under the Proposed Action is not expected to result in major pit wall stability problems during the mine construction and operation period. The 130-foot setback from the ultimate crest of the pit would reduce the risk to adjacent facilities associated with potential long term sloughing of the pit walls during the post closure period.

Waste Rock Disposal Facilities

The proposed project includes the construction of the West WRDF and East WRDF, as described in Section 2.3.3, Waste Rock Disposal Facilities. The height of the WRDFs would range from 210 to 615 feet above ground surface and would be constructed with 50- to 150-foot-thick lifts. The side slopes of the WRDFs would be graded to 3H:1V (horizontal:vertical [H:V]) for reclamation, except in areas of steep underlying terrain where the overall reclaimed slopes would be 2.5H:1V (Section 2.3.8.6, Reclamation of Proposed Project Facilities).

Available geologic information indicates that the proposed WRDFs footprints are underlain predominantly by Carlin Formation and Vinini Formation materials (Barrick Dee Mining Venture [BDMV] 2010b). Tetra Tech (2011a, 2009) conducted preliminary slope stability analysis for the WRDFs, assuming maximum heights ranging up to 680 feet (Tetra Tech 2011a). The Tetra Tech analyses assumed that the Carlin Formation materials would have the lowest strength properties compared to other rock units in the foundation. Carlin Formation materials also would comprise approximately one-third of the waste rock material to be placed in WRDFs. During mining and placement in the WRDFs, the Carlin Formation generally would break down into loose weak soil that, when exposed to water, potentially could be unstable if exposed on the outer shell of the facility. For these reasons, the stability analysis assumed conservative low strength properties for the waste rock material that contained Carlin Formation.

Results of the stability analysis indicated that a buttress of waste rock material that excluded Carlin Formation material was required to achieve the desired factor of safety of 1.3. The horizontal thickness of the waste rock buttress would be required to increase as a function of the total slope height to achieve the desired minimum factor of safety. The preliminary design for the WRDF's assumes that the mixed Carlin material would be placed in the interior of the WRDFs with stronger bedrock waste rock material placed as the outer shell to buttress the weaker soil like Carlin material. The results of this preliminary stability analysis indicated that the calculated minimum static and pseudostatic (i.e., seismic loading) factors of safety are above the generally accepted minimum factor of safety for waste rock disposal facilities.

Heap Leach Facility

The design for the proposed Heap Leach Pad No. 12 is summarized in Section 2.3.4.3, Heap Leach Pad Facility. The facility would be designed to store 80 MT of leachable ore and spent ore from three existing heap leach facilities located within the footprint of the proposed West WRDF.

The facility would be located on a gently southeast-facing slope. Available geologic mapping indicates that the site is underlain by a subunit of the Carlin Formation consisting of sand, silt, and mudstone with abundant tuff (Theodore et al. 2006). Interpretive geologic sections through the site infer that the Carlin Formation is over 1,000 feet thick throughout the site (BDMV 2010b).

Tetra Tech completed a geotechnical drilling program to characterize the subsurface materials in a portion of the facility footprint and conducted a preliminary assessment of slope stability of the proposed heap leach pad (Tetra Tech 2011b). The results of the preliminary slope stability evaluation indicate adequate factors of safety for static and pseudo-static conditions. Therefore, impacts associated with instability of the heap leach pad under static or seismic loading conditions are not anticipated. Minor settlement would occur beneath the heap leach facility due to loading; however, it presumably would not be great enough to impair the operation of the facility.

The existing ground surface at the lower end of the proposed facility is approximately 5,400 feet amsl, and the elevation of the regional groundwater surface is at approximately 3,600 feet amsl, indicating the depth to the regional water table is on the order of 1,800 feet beneath the ground surface as a result of dewatering activities at the BGMI facility (Section 3.3.1.1, Physiographic and Topographic Setting), for additional discussion). Prior to mine dewatering, the elevation of the regional groundwater surface at the proposed project site approximately was 5,240 feet amsl (e.g., 140 feet beneath the proposed facility site).

Based on the site conditions and depth to groundwater, liquefaction is not expected to be of major concern. The facility would be designed in accordance with state and federal regulations and with final 3H:1V slopes; therefore, construction, operation, and closure of the facility is not anticipated to result in geologic impacts resulting from geologic hazards or geotechnical instability.

BDMV proposes to construct one process solution pond and two storm water event ponds southeast of the heap leach pad and adjacent to the existing reclaimed Tailings Disposal Facility No. 2 (TD2). The conceptual design indicates that the process pond would have a capacity of 4 million gallons, and each storm water event pond would have a capacity of 7 million gallons. Preliminary investigation of the subsurface conditions indicates that although the ponds are located within the footprint of the permitted area for TD2, tailings is not present in the area where the ponds are located. It is possible that operation of TD2 was shut down before tailings covered the entire permitted area (Barrick Gold of North America 2012).

3.3.2.2 Single Waste Rock Disposal Facility Alternative

Under the Single WRDF Alternative, direct impacts on geologic and mineral resources would be the same as described for the Proposed Action: 1) the generation and permanent disposal of approximately 600 MT of waste rock and 64 MT of spent ore material; and 2) the mining of proven and probable ore reserves of approximately 2.2 million ounces of gold and 10.6 million ounces of silver. Potential geologic hazards and geotechnical issues associated with the design of all facilities except the single WRDF Alternative would be the same as described under the Proposed Action.

Under the Single WRDF Alternative, elimination of the East WRDF would reduce the surface disturbance compared to the Proposed Action. The estimated total disturbance for this alternative would be approximately 2,646 acres. Open-pit mining disturbance (601 acres), and construction of the West WRDF (1,161 acres) and heap leach pad (226 acres) would permanently alter the natural topographic and geomorphic features over approximately 1,988 acres. As with the Proposed Action, the open pit would not be reclaimed, while the WRDFs and heap leach pad would be reclaimed but still alter the topography and geomorphology of the study area. Other temporary facilities (e.g., stockpiles, process facilities, ancillary facilities, and haul roads) would be reclaimed to the approximate pre-mining topography and therefore would not permanently alter the natural topography and geomorphic features in the study area.

Waste Rock Disposal Facility

The general construction and design of the WRDF would be essentially the same as described for the West WRDF under the Proposed Action; (the side slopes of the WRDFs would be graded to 3H:1V for reclamation except in areas of steep underlying terrain where the overall reclaimed slopes would be 2.5H:1V). Although, the maximum height of the West WRDF would increase by approximately 40 feet, Tetra Tech (2011a, 2009) preliminary slope stability analysis for the WRDFs suggest that with incorporation of the waste rock buttress along the perimeter of the facility (that excludes Carlin Formation material) the single waste rock facility would be geotechnically stable. The horizontal thickness of the waste rock buttress would increase (compared to the Proposed Action) to accommodate the increase in height.

3.3.2.3 Partial Pit Backfill Alternative

Under the Partial Pit Backfill Alternative the mining would be sequenced to facilitate backfilling portions of the South and East Pit (Section 2.3.2, Open Pit). Although the disturbance footprint for the facilities would be the same as the Proposed Action the maximum height and storage of waste rock in the West and East WRDFs would be reduced compared to the Proposed Action. The geotechnical issues associated with the WRDFs and heap leach facility would be the same as discussed under the Proposed Action. The major differences between the Partial Backfill Alternative and the Proposed Action include the reduction in the size of the unreclaimed open pits at closure; reduction in potential for slope failures that could develop in the pit slopes in the postclosure period; and, loss in the future potential to expand the mining operation in the South Pit and East Pits to recover mineral resources that have been identified, but have not yet been confirmed to be economic.

Under the Proposed Action, there would be 601 acres of open pit that would not be reclaimed. The Partial Backfill Alternative would reduce the acres of unreclaimed open pit to approximately 310 acres.

Pit slopes typically experience some level of slope failure after active mining ceases. The risk of larger slope failures also tends to increase if the pit walls eventually become saturated by rebounding groundwater conditions. Placement of waste rock in the South Pit and East Pit would reduce the potential for pit slope failures that could potentially develop in the post closure period particularly after the water table recovers.

Considering the geologic setting for the ore deposit, it is likely that mineral resources extend beyond the boundary of the proposed pit areas. This mineralization is not currently economic to mine as part of the Proposed Action. As is the case for most mining projects in the Carlin Trend, there is always the potential that economic factors could change in the future (such as an increase in price of the metals or reduction in production cost) that would allow for expansion of the mine. Future exploration activities also could identify ore deposits in the vicinity of the project that would justify expansion of the mining operation. Placing backfill in the open pits would limit the potential to deepen or expand the pits or conduct underground operations from the backfilled pit areas.

3.3.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and impacts to geologic and mineral resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area would be conducted under existing authorizations. To date, the existing heap leach and tailings disposal facilities are fully reclaimed. There are no known geotechnical stability concerns associated with these existing heap leach and tailings disposal facilities. As a result, it is expected that these facilities would remain stable for the foreseeable future.

The existing Dee open pit is approximately 800 feet deep and was mined from 1984 to 2000. The pit was not backfilled or reclaimed. There are no large-scale landslide or pit failures in the pit. There is one area located in the lower southwest wall considered to be marginally stable (i.e., Factor of Safety near 1.0), as evidenced by the formation of tension cracks and slope monitoring data (Piteau Associates 2008). However, the slope section has not completely failed even after being exposed since the cessation of mining in 2000. Analysis of the current slope conditions in this area suggest that the rock in this area is failing as a result of anisotropic strength conditions involving shearing along a combination of joints and faults (Piteau Associates 2008). Based on this information, it is likely that a landslide eventually would develop in the southwestern wall of the pit. Failure of the pit wall in this area is not expected to impact other existing facilities.

3.3.3 Cumulative Impacts

The CESA for geology and minerals is defined in Section 3.3.1, Affected Environment, and is shown in **Figure 3.3-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs for mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**. There are 27 tracks of land leased for oil and gas exploration and 3 tracks leased for geothermal exploration in the study area. However, there currently is no existing or proposed oil and gas or geothermal development projects located within the study area. In addition, there are several active and inactive sand and gravel material sites located on both Bureau of Land Management (BLM) and private land near Carlin and south of Interstate 80 within the study area. Disturbance at individual sand and gravel sites ranges from less than 1 acre up to 40 acres with a total estimated disturbance of approximately 143 acres within the CESA.

3.3.3.1 Proposed Action

Mineral production in the CESA has included gold, silver, barite, lead, turquoise, and copper; most of the mineral production has come from gold and barite mining operations. In addition, the basin fill material has been mined intermittently as a source of gravel for road construction. Surface mining activity affects geology and mineral resources by excavating, modifying, or covering natural topographic and geomorphic features, and by removing mineral deposits.

Mining disturbance in the CESA has included exploration (drilling, trenching, sampling, and road construction), open-pit and underground mining, and construction of waste rock, heap leaching, ore milling and processing, and tailings disposal facilities. For the purpose of this evaluation, geologic disturbance is defined to include mine components such as open pits, waste rock areas, leach pads, and tailings impoundments that permanently alter the natural topographic and geomorphic features in the area, even if reclaimed. In addition to mining, other development in the region includes agricultural development and utilities/community development. Large portions of the CESA also have been affected by wildfires. For the purposes of this evaluation, agricultural, utility and energy development, community development, and wildfires are not considered to result in geologic disturbance, as defined above.

Based on available information, past, present, and RFFAs have or would result in approximately 42,092 acres of ground disturbance related to mining exploration and development within the CESA as shown in **Table 3.2-1**. Of this total, approximately 4,268 acres would remain as unreclaimed open pits, 9,118 acres would remain as reclaimed or unreclaimed waste rock and heap leach facilities, resulting in a total of 13,386 acres where the natural topography and geomorphology permanently would be altered.

The proposed project would result in an estimated 601 acres for expansion of the open pit which represents an approximate 14 percent increase in the cumulative total area that would remain after mining as unreclaimed open pits within the Carlin Trend. The total area for the open pit, the WRDFs, and heap leach pad facility is 2,123 acres. This acreage represents an approximate 16 percent increase in the total amount of land where the topography and geomorphology would be altered by mining in the Carlin Trend.

3.3.3.2 Single Waste Rock Disposal Facility Alternative

Potential cumulative effects to geology and mineral resources associated with the Single WRDF Alternative would be similar to those described under the Proposed Action with the following exceptions.

- Elimination of the East WRDF under this alternative would result in a small reduction in the cumulative amount of acreage where the topography and geomorphology would be altered by mining.
- The Single WRDF Alternative would result in an estimated 1,988 acres for expansion of the open pit, and development of the WRDFs and heap leach facility. These 1,988 acres represent an approximate 15 percent increase in the total amount of land where the topography and geomorphology would be altered by mining in the Carlin Trend.

3.3.3.3 Partial Pit Backfill Alternative

The potential cumulative effects to geology and mineral would be the same as those described under the Proposed Action with the following exceptions.

- The total area for the open pit, the WRDFs, and heap leach pad facility is 2,123 acres (same acres as for the Proposed Action). This acreage represents an approximate 16 percent increase in the total amount of land where the topography and geomorphology would be altered by mining in the Carlin Trend.
- Placing backfill in the open pits would limit the potential to deepen or expand the pits or conduct underground operations from the backfilled pit areas. These limitations could restrict future mineral development in the vicinity of the backfilled pits and potentially reduce the total precious metal development in the Carlin Trend in the future. The value of the potential loss in resources cannot be quantified but would depend on the mineralization (which is currently undefined) within this area and future economic conditions.

3.3.3.4 No Action Alternative

Implementation of the No Action Alternative would not result in any change in cumulative impacts to geology and mineral resources.

3.3.4 Potential Monitoring and Mitigation Measures

The Proposed Action and action alternatives would cause irreversible and permanent changes to the geology and topography that could not be minimized by the implementation of additional monitoring or mitigation measures. However, the following potential mitigation measure is proposed to address long-term facility stability for the Proposed Action and both alternatives.

Issue: Geotechnical designs for the process solution pond and storm water event ponds were not available for review as part of this Environmental Impact Statement.

Mitigation Measure GM-1: The proposed process pond and storm water event ponds would be designed, constructed, monitored, and maintained in a stable manner during both the operation and post-mining periods. Geotechnical investigations and stability analyses would be performed to demonstrate that these facilities would be properly designed and remain stable under both static and seismic loading conditions. The minimum factors of safety for all slope designs would be determined as part of the permits, inspections, and approvals granted by the Nevada Division of Water Resources (Dam Safety Division) and the BLM.

The geotechnical investigations for design of the ponds would evaluate the absence or presence of TD2 tailings. If tailings are present in the foundation areas, the thickness and geotechnical properties would be included in the stability analysis for final design of the ponds.

Effectiveness: Proper design, construction, and maintenance of the facilities outlined in this mitigation measure would effectively minimize potential impacts associated with facility stability during the operation and post-mining periods.

3.3.5 Residual Impacts

Residual impacts to geologic resources as a result of the proposed project are not anticipated.

3.4 Water Resources and Geochemistry

3.4.1 Affected Environment

3.4.1.1 Hydrologic Setting

The proposed project is located within the Humboldt River basin in north-central Nevada. The proposed project area is composed of the area encompassed by the Plan of Operations (PoO) boundary, the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occurs outside the project PoO boundary. These features are indicated in **Figure 2-2**. The Humboldt River flows westward within a closed basin that terminates at the Humboldt Sink south of Lovelock. The entire Humboldt River basin covers an area of nearly 17,000 square miles.

The proposed project is located within the Boulder Creek watershed within the Boulder Flat Hydrographic Area 61 (**Figure 3.4-1**). The headwaters of Boulder Creek are in the Tuscarora Mountains located east of the proposed project. The hydrologic study area for direct and indirect impacts to water resources consists of the project area and the upper Boulder Creek watershed including tributaries that join Boulder Creek upgradient of Rodeo Creek (approximately 0.25 mile upgradient of Boulder Valley Monitoring Plan (BVMP) monitoring station BC-A located in **Figure 3.4-2**). This comprises a watershed area of approximately 74 square miles (approximately 47,360 acres). Elevations in the study area range from approximately 6,100 feet above mean sea level (amsl) along the watershed divide, to approximately 5,200 feet amsl along Boulder Creek (**Figure 3.4-2**).

The Cumulative Effects Study Area (CESA) for water resources encompasses six designated hydrographic basins and approximately 2,105 square miles. These six hydrographic basins are listed in **Table 3.4-1** and shown in **Figure 3.4-1**. All six basins drain southward to the Humboldt River. The CESA is bounded by the Tuscarora Mountains on the north, the Adobe Range and the Independence Mountains on the east, and the Humboldt River on the south. The western boundaries of the Willow Creek and Rock Creek groundwater basins form the western boundary of the CESA. Elevations within this CESA range from 8,800 feet amsl in the Tuscarora Mountains to 4,500 feet amsl along the Humboldt River. The CESA for water resources in this Environmental Impact Statement (EIS) is identical to the CESA analyzed in the Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project (Bureau of Land Management [BLM] 2000b), Betze Project Draft Supplemental EIS (BLM 2000c), Betze Pit Expansion Project Draft Supplemental EIS (BLM 2008b), Leeville Project Final Supplemental EIS (BLM 2010b), and South Operations Area Project Amendment Cumulative Effects Final Supplemental EIS (BLM 2010a).

Table 3.4-1 Hydrographic Basins Within the CESA for Water Resources

Nevada Designated Hydrographic Basins	Basin Number	Approximate Land Area (square miles)
Susie Creek Area	50	220
Maggie Creek Area	51	410
Marys Creek Area	52	60
Boulder Flat	61	560
Rock Creek Valley	62	450
Willow Creek Valley	63	405

Sources: Maurer et al. 1996; Nevada Division of Water Resources (NDWR) 2010a.

Regionally, the average annual precipitation varies, but it generally increases with elevation. Most of the precipitation falls during winter and spring. Historically, total annual precipitation generally has ranged from 14 to 20 inches at higher elevations in the Tuscarora Mountains to less than 10 inches at lower elevations on Boulder Flat (U.S. Department of Agriculture-Natural Resources Conservation Service 1998). In the study area, the average annual precipitation is approximately 10.7 inches (SRK Consulting [U.S.], Inc. [SRK] 2010a). The months of July, August, and September are relatively dry, and most precipitation occurs during November through March. The average annual lake evaporation is approximately 44.6 inches (SRK 2010a), far exceeding precipitation amounts. Most rainfall and snowmelt is removed by evapotranspiration; the remainder recharges groundwater.

3.4.1.2 Surface Water Resources

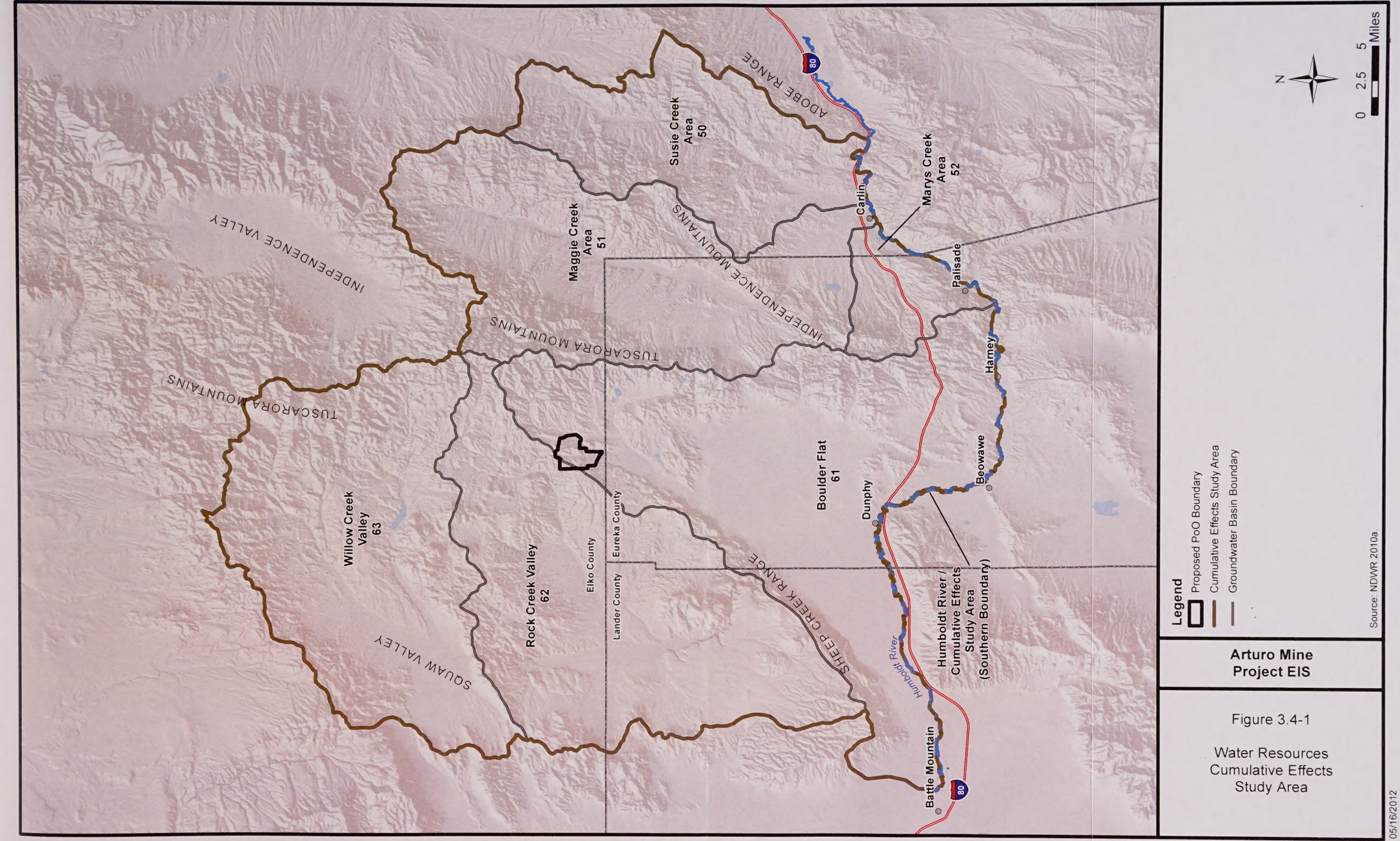
This section describes surface water resources from the standpoint of water quantity, water quality, and related features such as stream channels, diversions, ponds, and springs. It also describes water features for subsequent assessment of potential impacts to water quantity and quality. Habitat features, ecological relationships, and other biological or terrestrial considerations have been included by reference, but are assessed in detail in other sections of the EIS.

Streams and Ponds

The study area is dominated by unnamed, relatively steep, ephemeral channels that drain towards Boulder Creek. Boulder Creek is located immediately east of the proposed PoO boundary (**Figure 2-2**). Investigators mapped eight ephemeral stream channels within the study area, including three segments that no longer reach Boulder Creek (JBR Environmental Consultants, Inc. [JBR] 2009). Typical streambed slopes within the study area range from 1 to 5 percent (approximately 50 to 260 feet/mile) (Cedar Creek Associates, Inc. [Cedar Creek] 2009). The channel beds are generally less than 2 feet wide, and the depths are shallow, typically 2 inches or less (JBR 2009) indicating low flow rates. The channel substrates are usually gravelly but can be composed of coarser cobbles where larger flows have occurred. Field investigations indicate that annual vegetation similar to the adjacent plant community is common within the ephemeral channels, indicating that flows in these streams typically occur before most of the growing season (JBR 2009).

Flows in Boulder Creek near the study area are monitored monthly in the northwest quarter of the southwest quarter, Section 2, Township 36 North, Range 49 East (BC-AA) (Barrick Dee Mining Venture [BDMV] 2010e). Recent discharges range from dry in late February 2010, up to 12,640 gallons per minute (gpm) (28.2 cubic feet per second) in late May 2009. The maximum recorded recent flow in Boulder Creek adjacent to the proposed PoO boundary was 37,221 gpm (82.9 cubic feet per second) in late April 2006 (BDMV 2010e). The stream is typically dry from late June or July until March.

Based on a review of aerial photography and existing data, three small impoundments that are used for runoff and sediment control or stock watering exist within the study area. The largest of these is approximately 2 acres in size encompassing locations AR36 and AR09, which was built in 1964 by the BLM as a detention pond to reduce sedimentation in Boulder Creek resulting from wildfires. An additional impoundment (including sample site AR05) is located a short distance downgradient within the PoO boundary. The upper impoundment (including sample sites AR09 and AR36) receives direct surface runoff from the existing Dee project components as well as project seepage through a limestone-lined french drain. The lower impoundment was originally created as a temporary stock watering feature. Both of these ponds seep, allowing the formation of wetlands. As discussed above, the upgradient 2-acre pond was originally constructed as a detention pond, which means this impoundment was designed and constructed to leak and temporarily hold a minimal amount of water. This impoundment was modified by the Dee Gold Mining Company over time. Wetland features and ecology are discussed in Section 3.14, Vegetation, Including Riparian Zones and Wetlands.

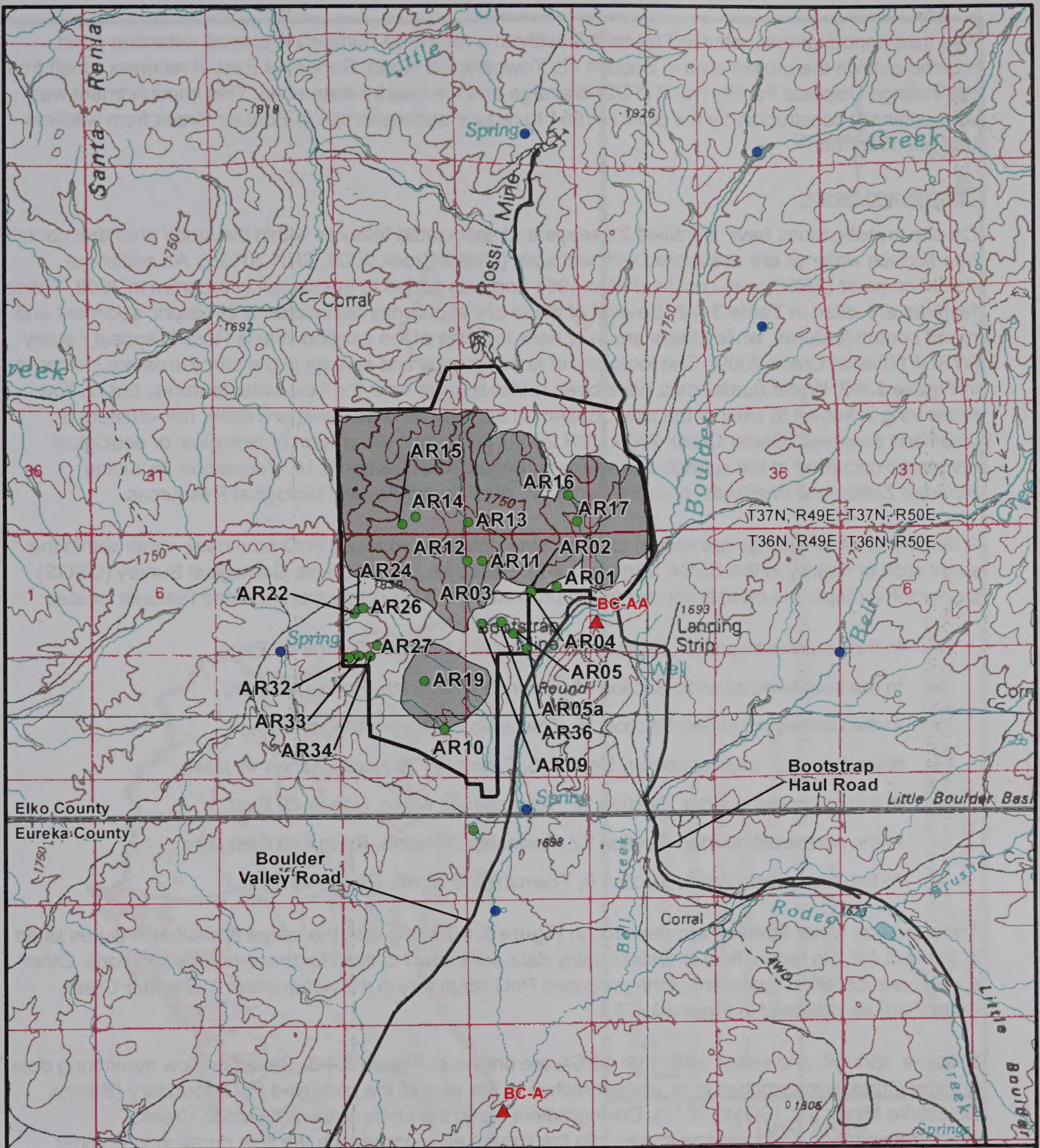


Source: NDWR 2010a.

Figure 3.4-1

Water Resources Cumulative Effects Study Area

05/16/2012



Legend

▭ Proposed PoO Boundary

▨ Proposed Facilities

▲ Stream Monitoring Stations: BC-AA and BC-A

● Seep, Catchment, or Sample Location

● Spring

Note: Sample Location ANT-1A located off figure, approximately 5 miles north of proposed project.
Refer to **Figure 2-3** for waterbody impoundment locations.
Source: BLM 2012; Cedar Creek Associates 2009.

N

0 0.5 1 Miles

Arturo Mine Project EIS

Figure 3.4-2

Water Features in and Near the Study Area

5/24/2012

The third impoundment noted in **Figure 2-3** (without a reference number) is a small detention pond located outside the project area in Section 15, Township 36 North, Range 49 East. It receives runoff from the Tailings Disposal Facility No. 2 (TD2) drainage and the nearby watershed. This impoundment was also originally constructed by the BLM in 1964 to reduce sedimentation in Boulder Creek from wildfires that occurred then.

Springs and Seeps

On-site investigations have identified 22 seeps and associated features within the study area that contain free surface water or are associated with wet soils (Cedar Creek 2009; SRK 2010b). An additional detention pond (AR36) was constructed in 1964 and was added to the sampling program in 2009. These features are listed in **Table 3.4-2**. Several of these are apparently associated with historic sediment and runoff control features, while others are at or near the toes of the existing Waste Rock Disposal Facility (WRDF) (Cedar Creek 2009). The locations of known seeps and springs in the study area are indicated in **Figure 3.4-2**. Water quality data have been retrieved at or near the free-water features, but no flow monitoring is known to exist at the sites. Based on site visit records, flows are either non-existent or small and seasonal (Cedar Creek 2009; JBR 2009). Additional discussion of biological or ecological resources occurring at the springs and seeps is presented in Section 3.14, Vegetation, Including Riparian Zones and Wetlands, or in Section 3.17, Wildlife and Aquatic Biological Resources.

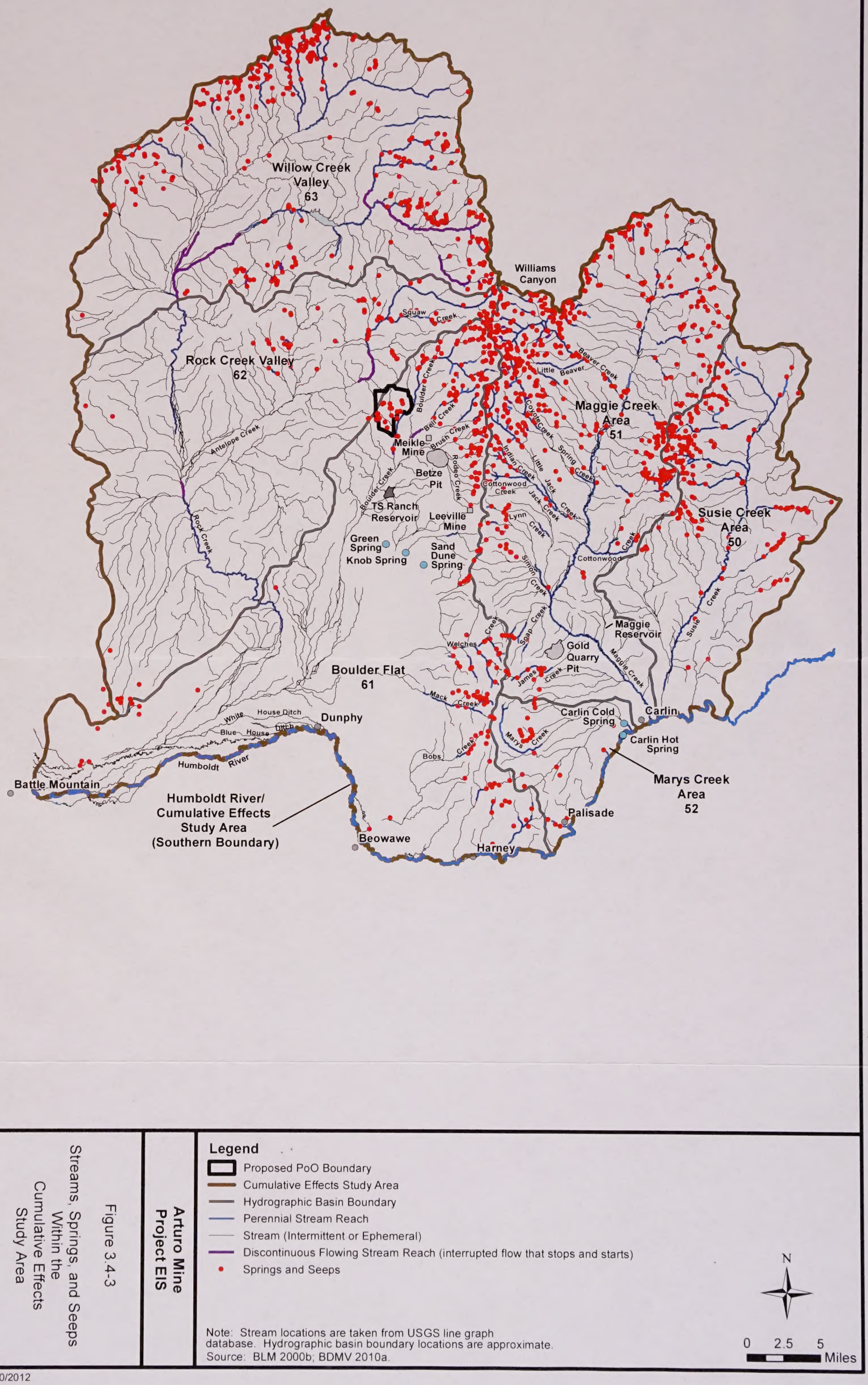
A number of other springs are known to be located near the proposed PoO boundary, either within the study area or nearby in the CESA (**Figure 3.4-2**). Based on United States Geological Survey (USGS) topographic maps, the closest springs to the proposed PoO boundary are unnamed features located:

- In the southwest quarter, Section 13, Township 37 North, Range 49 East;
- In the southeast quarter, Section 15, Township 37 North, Range 49 East;
- In the northeast quarter, Section 25, Township 37 North, Range 49 East;
- Near the south quarter corner, Section 5, Township 36 North, Range 49 East;
- In the northwest quarter, Section 15, Township 36 North, Range 49 East;
- In the northwest quarter, Section 22, Township 36 North, Range 49 East; and
- At the southwest corner, Section 6, Township 36 North, Range 48 East.

These nearby water features are depicted in **Figure 3.4-2** along with the seeps and other features listed in **Table 3.4-2**. No recent flow or water quality data are known to exist for these nearby locations. Other springs are identified upstream of the proposed PoO boundary in the headwaters of Boulder Creek watershed, as indicated in **Figure 3.4-3**.

Streams, springs, and seeps within the CESA are shown in **Figure 3.4-3**. Based on flow monitoring data, Boulder Creek is intermittent in its upper reaches to the east of the proposed PoO boundary (Barrick Goldstrike Mines Inc. [BGMI] 2010). Downgradient along the channel toward Rodeo Creek, evapotranspiration and seepage losses into the stream alluvium reduce the flow duration in Boulder Creek to ephemeral conditions (BLM 2008b, 2000c, 1991a). Downgradient in Boulder Valley (also known as "Boulder Flat"), these temporary channel flows are routed into a series of agricultural diversions in combination with Rock Creek flows (JBR 2009). Boulder Creek is ephemeral on the valley surface of Boulder Flat. Boulder Creek has no hydrologic connectivity with Rock Creek ditch or the Humboldt River as discussed below in Waters of the United States.

East of the Tuscarora Mountains, major tributaries to the Humboldt River include Maggie Creek, Marys Creek, and Susie Creek (**Figure 3.4-3**). These drainages have been extensively investigated by



Note: Stream locations are taken from USGS line graph database. Hydrographic basin boundary locations are approximate.
Source: BLM 2000b; BDMV 2010a.

Arturo Mine Project EIS

Figure 3.4-3

Streams, Springs, and Seeps Within the Cumulative Effects Study Area

5/30/2012

Table 3.4-2 Seeps and Other Features Within the Study Area

Inventory Number	Feature Type
AR01	Seep wetland, occasional open water
AR02	Probable seep
AR03	Seep
AR04	Seep
AR05 and 05a	Drainage bottom wetlands and pond, open water
AR09	Sampling location on upstream end of BLM detention pond; wetland, spring and open water
AR10	Seep or catchment
AR11	Mostly dry mine constructed basin
AR12	Mostly dry mine-excavated area
AR13	Seep or catchment
AR14	Remnant constructed collection pond
AR15	Remnant constructed collection pond
AR16	Seep and marginal wetlands
AR17	Drainage bottom wetland
AR19	Seep
AR22	Seep or catchment
AR24	Seep or catchment
AR26	Seep or catchment
AR27	Seep wetland
AR32	Seep or catchment
AR33	Seep or catchment
AR34	Seep or catchment
AR36	Sampling location on downgradient end of BLM detention pond; open water

Source: Cedar Creek 2009.

Maurer et al. (1996), the USGS (Prudic et al. 2006), and others. Maggie Creek and Susie Creek are dominantly perennial streams (BLM 2008b). West of the Tuscarora Mountains, Rock Creek is the major tributary to the Humboldt River within the CESA. That channel traverses the southwestern portion of Boulder Valley before joining the river near the town of Battle Mountain (**Figure 3.4-3**). Further detail about flows in Boulder Valley and other streams in the CESA was provided in previous National Environmental Policy Act (NEPA) documents (BLM 2008b, 2000b,c, 1991a).

Flood Hydrology

No regulatory floodplain (Flood Hazard Zone A) delineations have been made by the Federal Emergency Management Agency (FEMA) in the study area or nearby along Boulder Creek (FEMA 2010). The nearest FEMA Zone A delineation on Boulder Creek is located approximately 1 mile south of the Elko-Eureka county line, downgradient of a point approximately 1.2 miles north of Rodeo Creek. From a geomorphic perspective, narrow floodplain deposits or low-lying areas that would be inundated from a large precipitation or snowmelt event occur along all of the ephemeral streams in the proposed project area. Inundated channel areas probably would be on the order of 10 feet wide at most locations (Cedar Creek 2009; JBR 2009) depending on the size of a particular runoff event. The 100-year, 24-hour point precipitation for the study area is 2.60 inches (SRK 2010a).

Waters of the United States

Field investigations to evaluate the potential jurisdictional status of ephemeral channels and wetlands within the proposed project area were performed by JBR in late summer of 2009. All isolated waterbody features that are solely contained in the proposed project area were mapped, as well as features that have a potential tributary connection to Boulder Creek (JBR 2009).

The JBR survey documented that the Ordinary High Water Mark associated with Boulder Creek ceases to exist 17.4 stream miles downgradient of the proposed project area (at a location 6.7 miles upgradient of the Rock Creek Ditch) (JBR 2009). The distance from the Rock Creek Ditch to the Humboldt River is approximately 25 miles. Because Boulder Creek lacks a regular or frequent direct connection with the Humboldt River, tributaries of Boulder Creek (and, correspondingly, any associated wetlands) present within the proposed project area were determined to be isolated (JBR 2009). In addition to the lack of any direct channel connection between the proposed project area and downgradient waters, there are no interstate commerce uses for Boulder Creek or for any channel or wetland located within the proposed project area (JBR 2009). The investigation concluded that Boulder Creek, its tributaries, and all waterbody features found in the proposed project area are not subject to federal jurisdiction, and thus not regulated, under Section 404 of the Clean Water Act (JBR 2009). The United States Army Corp of Engineers (USACE) formally concurred with this conclusion in a letter dated August 13, 2010 (USACE 2010).

Existing Mining Water Management Facilities in the Project Area

As described in Chapters 1.0 and 2.0, a number of mine-water control and process-water management features currently exist within the proposed project area. Existing and authorized disturbance in the proposed project area is depicted in **Figure 2-1**. Process-water management features for the heap leach facilities, mill, and solution processing facilities have been reclaimed (SRK 2009a).

Current features include runoff collection and sedimentation impoundments (described above under *Streams and Ponds*), as well as two tailings disposal facilities under various stages of reclamation. The footprint for Tailings Disposal Facility No. 1 (TD1) occupies approximately 87 acres, and the permitted footprint for TD2 occupies approximately 83 acres (SRK 2009a). The TD1 embankment face has been reduced to a flatter angle for reclamation except where the road to the water tank exists on the dam (Telesto Nevada 2004). TD1 and TD2 have been reclaimed and vegetation has been established. Diversion ditches designed for the 100-year, 24-hour runoff event are in place to divert water around these features.

Watersheds

The regional hydrologic setting is described in Section 3.4.1.1, Hydrologic Setting. This watershed discussion examines general runoff conditions over large drainage areas from a hydrologic perspective.

Influences on runoff and sedimentation include snowmelt and rainfall, topography and soil characteristics, vegetation conditions, drainage controls and conservation practices. On a regional basis, overland flow originates from snowmelt or rainfall on hillslopes and more gently sloping alluvial fans and valley floors. Infiltration and porosity are typically greater on the lower depositional features, and runoff is sometimes completely absorbed downslope before reaching a stream channel.

Other land surface influences, such as grazing, fire, mining and exploration activities, and roads, also affect runoff conditions within the study area and CESA. While grazing is the most extensive land use activity within the CESA, rangeland fires are very common. Approximately 59 percent of the water resources CESA, including some of the project study area, has been burned by wildfire (**Figure 3.2-3**).

Much of the CESA has been burned by wildfire more than once since 1985. The primary areas where fire has not recently occurred include most of Boulder Flat, and lower elevations in the southwestern part of Rock Creek Valley, and Squaw Valley.

In the CESA, which occupies approximately 2,105 square miles (approximately 1.35 million acres), ongoing disturbance from mines and exploration activities occupies approximately 35,344 acres (approximately 55.2 square miles). This is approximately 2.6 percent of the land area within the water resources CESA. Additional surface disturbance from roads, pipelines, and transmission lines also exists within the CESA.

3.4.1.3 Groundwater Resources

Recharge, storage, and movement of groundwater is dependent in part on the geologic conditions and topography of a site. The general stratigraphic and structural framework throughout the hydrologic study area and the proposed project area are described in Section 3.3, Geology and Minerals. For the purpose of characterizing the groundwater conditions in the area, the geologic formations have been grouped into six hydrostratigraphic units. The general physical characteristics of these units are presented in **Table 3.4-3**.

Table 3.4-3 Summary of Hydrostratigraphic Unit Properties

Hydrostratigraphic Unit	Reported Yields (gpm)	Estimated Hydraulic Conductivity (feet per day)	Estimated Transmissivity (square feet per day)	Estimated Specific Yield (no units)
Younger Basin Fill	Up to 3,600 in Boulder Valley[2]	1 - 100[2]	4,500[1] - 13,400[2]	0.15 - 0.252[2]
Older Basin Fill	<100 - 1,000[1]	0.05 - 5[2]	20 - 14,000[2]	0.01 - 0.10[2]
Intrusive Rocks	Generally <100[2]	0.01 - 1[2]	NA	NA
Volcanic Rocks	Up to 5,800 in Boulder Valley[2]	0.5 - 200[2]	300 - 100,000[2]	0.0007 - 0.07[2]
Marine Clastic Rocks	10 - 600[2,3]	0.01 - 0.5[2]	30 - 800[2]	0.0001 - 0.004[2]
Marine Carbonate Rocks	500 - 5,000[2]	0.1 - 100[2]	13 - 300,000[2]	0.0002 - 0.03[2]

[1] Source: Maurer et al. 1996.

[2] Source: McDonald Morrissey Associates, Inc. (MMA) 1998, 1996a,b.

[3] Where highly fractured, may yield more than 600 gpm.

NA – No data available.

These six hydrostratigraphic units include two distinct types of materials: fractured rock (carbonate, siliceous, intrusive, volcanic, and bedrock), and unconsolidated to poorly consolidated sediments (alluvial and basin fill deposits). In the bedrock units, recharge, storage, flow, and discharge of groundwater primarily are controlled by the secondary features (i.e., fractures, faults, and solution cavities) that enhance the porosity and permeability of the rock. In the unconsolidated to poorly consolidated sediment, the groundwater is stored and transmitted through interconnected pores within the sediments.

Hydrogeologic Units

The six hydrostratigraphic units and their hydrogeologic characteristics are discussed below.

Marine Carbonate Rocks

The Paleozoic marine carbonate rocks consist of limestone and dolomite and lesser amounts of shale, sandstone, and quartzite that are part of the lower plate. These rocks are mainly Cambrian to Devonian in age but locally also include Pennsylvanian/Permian carbonate rocks. These rocks are part of the Carbonate Rock Aquifer Province, a major bedrock carbonate aquifer system that covers extensive areas in eastern Nevada (Prudic et al. 1995). Regional maps infer that the northwestern boundary of the Carbonate Rock Aquifer Province is located near the proposed project area (Prudic et al. 1995). Carbonate rocks appear at the surface in the Tuscarora Mountains south of the Betze-Post Pit and in bedrock outcrops in the Maggie Creek and Susie Creek basins. Carbonate rocks are believed to underlie the younger units and the marine clastic rocks (beneath the Roberts Mountain Thrust) in areas within the carbonate rock province. In areas of carbonate rock outcrop, the overlying clastic rocks and younger volcanics are thought to have been removed by erosion (MMA 1996a).

The marine carbonate rocks have low primary permeability. However, where they are faulted or fractured coupled with dissolution, their transmissive properties greatly increase. Secondary permeability can raise the hydraulic conductivity of the marine carbonate rocks approximately 100 feet per day and result in a transmissivity as high as 300,000 square feet per day. The specific yield for these rocks ranges from 0.0002 to 0.03. Yields from wells range from 500 to as much as 5,000 gpm due to secondary permeability.

Marine Clastic Rocks

The Paleozoic marine clastic rocks consist of interbedded shale, siltstone, chert, quartzite, and limestone. Marine clastic rocks are believed to underlie the alluvium and volcanic rocks in most of the study area, and they form the upper plate of the Roberts Mountain Thrust. These clastic rocks are exposed in the Tuscarora Mountains, Independence Range, and Adobe Range (**Figure 3.3-2**). They have been extensively thrusted and eroded, and estimates of their thickness range from 50 to 5,000 feet. These rocks are fine-grained and have low hydraulic conductivity with most reported values ranging from 0.01 to 0.5 feet per day (MMA 1996a), but local faulting, fracturing, and solution widening can increase secondary permeability (Maurer et al. 1996). Transmissivity ranges from 30 to 800 square feet per day, and the specific yield ranges from 0.0001 to 0.004. Well yields are low and in the range of 10 to 600 gpm.

Intrusive Rocks

Tertiary through Jurassic intrusive rocks are a minor component of the rock types in the study area and consist mostly of granodiorite, quartz monzonite, monzonite, and diorite. The intrusive rocks tend to form relatively impermeable boundaries or impediments to groundwater flow. Reasonable estimates of hydraulic conductivity are 0.01 to 1 feet per day, and wells generally yield less than 10 gpm (MMA 1996a). Wells completed in the intrusive rocks may yield small quantities of water near some faults (Maurer et al. 1996).

Volcanic Rocks

The volcanic rocks consist of Tertiary through Jurassic aged rocks that include a wide range of igneous rock types: rhyolitic to basaltic lava flows, welded and nonwelded ash-fall tuffs, flow breccia, and tuffaceous sedimentary rocks. The volcanics occur throughout the area with most of the exposures in the western, northern, and south-central portions of the CESA. This wide range of rock types results in highly variable hydraulic parameters. The welded tuff, basalt, and andesite generally have low transmissive properties, while the rhyolite, particularly where fractured, is more transmissive. Estimates of hydraulic conductivity range from 0.01 to 200 feet per day, with transmissivity ranging from 300 to as much as 100,000 square feet per day. The specific yield has been estimated to range from 0.0007 to 0.07 in the case of the Boulder Valley rhyolite. Yields to wells can be up to 5,800 gpm.

Older Basin-fill Deposits

The older basin fill deposits (including the Carlin Formation) are Pliocene to Miocene age and are primarily composed of poorly consolidated shale, claystone, mudstone, siltstone, sandstone, conglomerate, freshwater limestone, tuff and lava flow (Maurer et al. 1996; Plume 1995). These deposits accumulated in basins that developed in the earliest stages of extensional faulting. In the upper Maggie Creek basin, these deposits are estimated to be up to 6,000 feet thick. In Susie Creek and lower Maggie Creek basins, the deposits are generally less than 2,000 feet thick (Hydrologic Consultants, Inc. 1999). Wells completed in the Carlin Formation have reported yields ranging from less than 100 to 1,000 gpm. In the Maggie Creek area, hydraulic conductivity ranges from 1 to 7 feet per day and transmissivity from 780 to 9,800 square feet per day (Maurer et al. 1996). In the northern part of Boulder Flat, transmissivity is estimated to range from 70 to 300 square feet per day. Locally, the fine-grained beds act as an aquitard producing confined groundwater conditions in the underlying rocks (BLM 1991a). The estimated specific yield is in the range of 0.01 to 0.10.

Younger Basin-fill Deposits

The Quaternary alluvium contains a wide range of materials: sandy clay, silty sand, gravelly sand, and sandy gravel. The thickness and lateral extent of this material also is highly variable. In higher elevation mountain areas, the alluvium occurs as discontinuous to continuous strands of unconsolidated material covering or partially covering bedrock along the floor of the valley or ravine. Alluvium in higher elevation areas generally is less than a few tens of feet thick. In broad basin areas, such as Boulder Flat, and to a lesser extent in the Maggie Creek and Susie Creek basins, the alluvium occurs as sequences of unconsolidated to poorly consolidated material up to 1,000 feet thick (MMA 1996a). Overall, the alluvium is generally coarser-grained in the mountains and finer-grained in the basins, and it becomes finer toward the center of the basin. The alluvium also is characterized by significant lateral and vertical stratigraphic variation with clay typically occurring as thinly bedded lenses. The alluvium generally is presumed to be an unconfined aquifer; however, semi-confined conditions may exist locally where less permeable fine-grained units inhibit vertical flow. Well yields can range up to 3,600 gpm in Boulder Valley, with hydraulic conductivities ranging from 1 to 100 feet per day, transmissivity ranging from 4,500 to 13,400 square feet per day, and a specific yield estimated to range from 0.15 to 0.25.

Hydrostructural Units

Faults can serve as pathways for groundwater flow or act as barriers to flow, depending on the nature of the brecciation along the fault and the permeability of units juxtaposed by the faulting. Fractures, bedding planes, and cavities in bedrock units often allow for local flow of groundwater and create increased permeability over a defined area. Long-term monitoring of water level changes in the vicinity of the BGMI facility has resulted in the recognition of three major fault zones that impede groundwater flow across the fault zone: Boulder Narrows Fault, Siphon Fault, and Post Fault. Other faults with the potential to influence groundwater flow and groundwater dewatering are the Little Boulder Basin Fault, the Tuscarora Fault on the east side of the Tuscarora Mountains, and the Gold Quarry Fault. The influence of these structures on the groundwater flow system generally is characterized by a noticeable change in gradient and water levels on either side of the faults. These hydrostructural features are described in the Betze Project, Draft Supplemental EIS (BLM 2000c) and Betze Pit Expansion Project, Draft Supplemental EIS (BLM 2008b).

Groundwater Levels

BGMI has monitored water levels in the regional aquifer system in the Boulder Valley, Rock Creek, and Willow Creek hydrographic basins since 1991 as a condition of their water rights permits. This monitoring system includes several wells located within and near the vicinity of the proposed project area (**Figure 3.4-4**). The water level contours indicate that the regional groundwater elevations range from approximately 5,200 feet at the northeastern corner to approximately 3,576 feet in the southeastern portion of the proposed project area. The water level contours also infer that hydraulic gradient for the regional groundwater aquifer system slopes steeply from north to south in the northern portion of the proposed project area, and west to east along the western portion of the proposed project area. In contrast, the water level elevations in the southeastern portion of the proposed project area are essentially flat and equivalent to the water levels at the Betze-Post Pit located approximately 3.9 miles south of the proposed project boundary.

Figure 3.4-5 shows the change in groundwater elevation (i.e., drawdown) since dewatering at the BGMI facility was initiated in 1990. Mine dewatering for the Betze Pit was initiated in 1990 and continued through 2010. The target dewatering elevation for the Betze/Post Pit of 3,576 feet amsl was reached in 2000 (John Shomaker & Associates, Inc. [JSA] 2010a). Since that time, the mine dewatering operations have continued to maintain water levels at the approximate 3,576 elevation. Mine dewatering activities at the BGMI facility have resulted in lowering the groundwater levels approximately 1,700 feet within an approximately 2.5-mile-wide northwest-trending zone that extends from the Betze-Post Pit to near the center of the proposed project area. Groundwater pumping for mine dewatering at the BGMI facility is projected to continue until the end of 2021, and additional pumping for mine reclamation and mine processing activities would continue through 2034 (JSA 2010b).

Water Quality Standards

Waters of the State of Nevada are defined in Nevada Revised Statutes Chapter 445, Section 445.191 and include, but are not limited to: 1) all streams, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems, and drainage systems; and 2) all bodies of accumulations of water, surface and underground, natural or artificial.

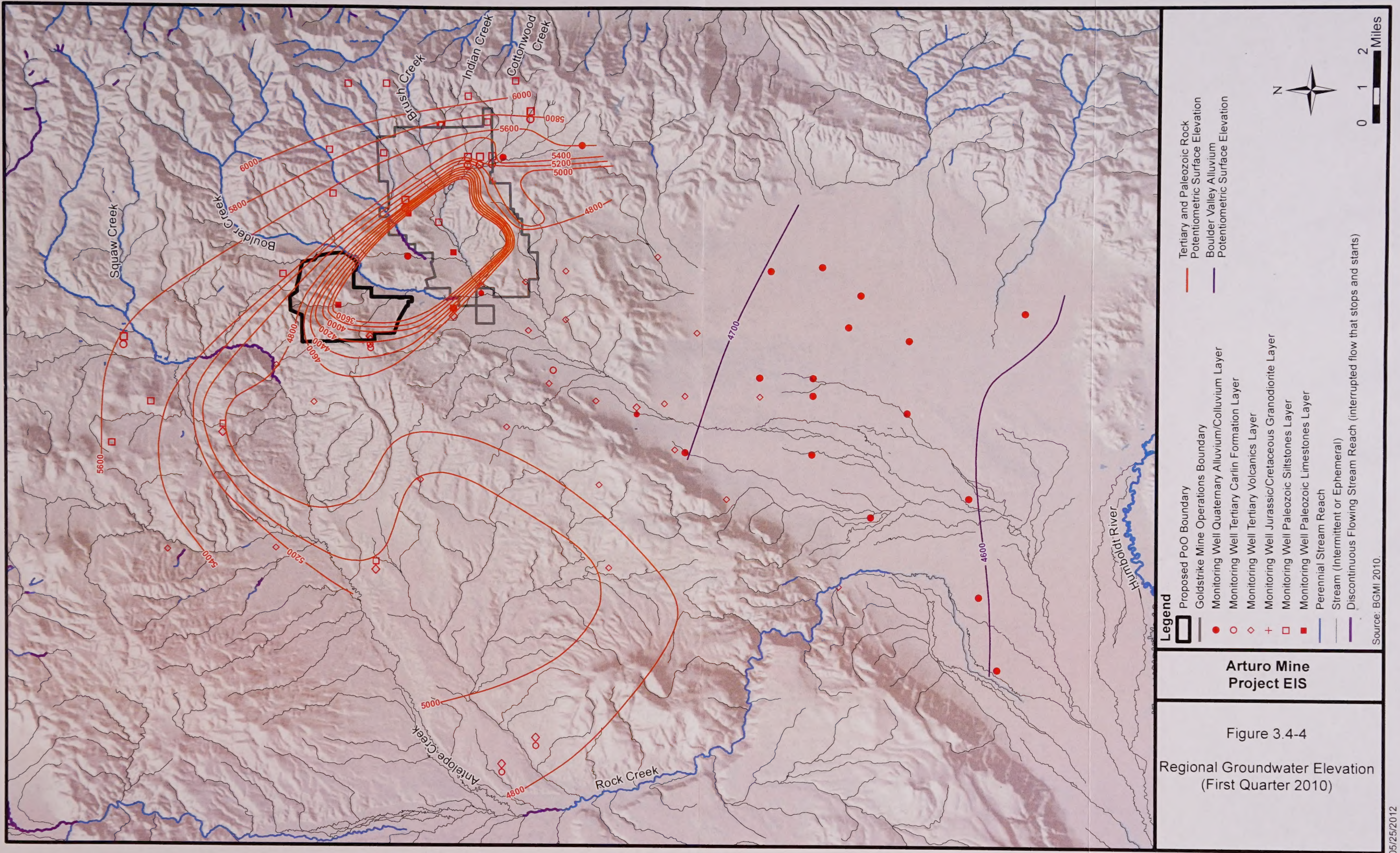
Water quality standards for state waters have been established by the State of Nevada under Nevada Administrative Code (NAC) 445A.117 through 445A.128. NAC 445A.453 establishes primary water quality standards, and NAC 445A.455 establishes secondary standards for water quality. General Nevada water quality standards are summarized in **Table 3.4-4**. Primary standards are based on the potential use of groundwater for drinking water and are established to protect human health; the secondary standards are for aesthetic qualities. These standards also are referred to as Maximum Contaminant Levels (MCLs). Because groundwater downgradient of the project has the potential to be used for drinking water, the Nevada drinking water standards would apply to mine-related activities that affect groundwater (NAC 445.424).

Surface water quality standards indicated in **Table 3.4-5** represent more specific values for streams designated as Class C waters by the state of Nevada. Designated Class C surface waters, such as Rock Creek, have stream standards identified by the state in NAC 445A.121 and .122, NAC 445A.126, and NAC 445A.144. Because of the questionable drainage continuity in lower Boulder Flat, it is currently unknown if Class C standards apply to Boulder Creek and its tributaries within the project area. The standards indicated in **Table 3.4-5** are included simply for reference and as a basis for discussion.

Surface Water Quality

Surface water sampling has been conducted in the proposed project area since the second quarter of 2008 (SRK 2010b), and on Boulder Creek at Sites BC-AA and BC-A nearby since March 1993 (BGMI 2010; BDMV 2010e). On-site sampling efforts were conducted at seep, spring, and pond sites shown in **Figure 3.4-2**. Sampling results are summarized in **Table 3.4-5**. Based on **Table 3.4-5,** most of the water quality constituents analyzed in the samples have levels within the reference Class C water quality standards.

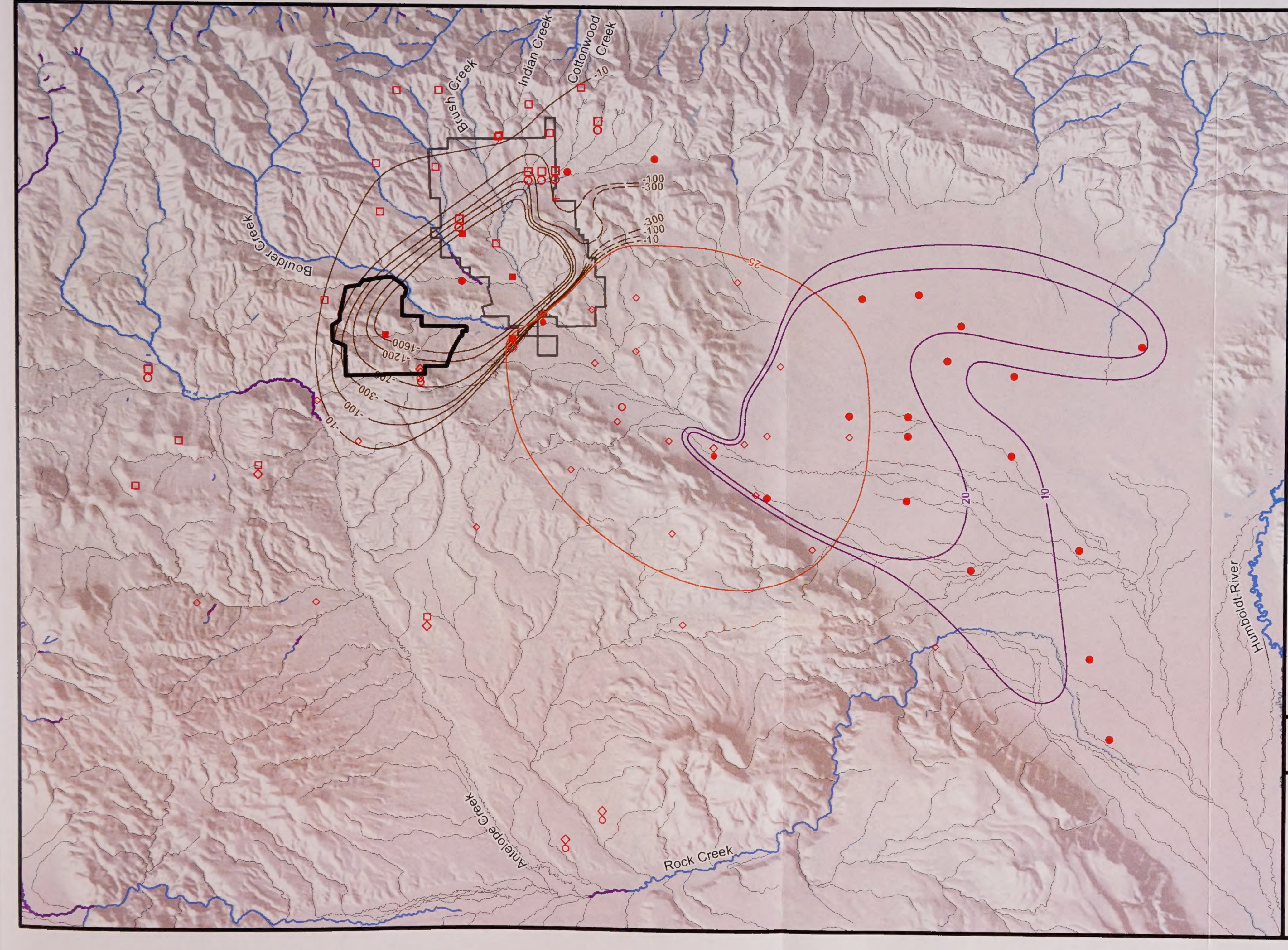
Monitoring records indicate that at most of the sites, for most of the time, sufficient free water did not exist to allow sample retrieval (SRK 2010b). Due to moisture conditions, samples were intermittently obtained at Sites AR05, AR17, AR27, and AR34. At Sites AR09 and AR36 (**Table 3.4-5** and **Figure 3.4-2**) samples consistently were retrieved and analyzed.


Squaw Creek
Boulder Creek
Brush Creek
Indian Creek
Cottonwood Creek
Humboldt River
Antelope Creek
Rock Creek
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
4700
4600
Legend
Proposed PoO Boundary
Goldstrike Mine Operations Boundary
Monitoring Well Quaternary Alluvium/Colluvium Layer
Monitoring Well Tertiary Carlin Formation Layer
Monitoring Well Tertiary Volcanics Layer
Monitoring Well Jurassic/Cretaceous Granodiorite Layer
Monitoring Well Paleozoic Siltstones Layer
Monitoring Well Paleozoic Limestones Layer
Perennial Stream Reach
Stream (Intermittent or Ephemeral)
Discontinuous Flowing Stream Reach (interrupted flow that stops and starts)
Source: BGMI 2010.
Tertiary and Paleozoic Rock Potentiometric Surface Elevation
Boulder Valley Alluvium Potentiometric Surface Elevation
N
0
1
2
Miles

Arturo Mine Project EIS

Figure 3.4-4

Regional Groundwater Elevation (First Quarter 2010)


Brush Creek
Indian Creek
Cottonwood Creek
Boulder Creek
Humboldt River
Antelope Creek
Rock Creek
-10
-100
-300
-300
-100
-10
-1600
-1200
-200
-300
-100
-10
25
20
10
Legend
Proposed PoO Boundary
Goldstrike Mine Operations Boundary
● Monitoring Well Quaternary Alluvium/Colluvium Layer
○ Monitoring Well Tertiary Carlin Formation Layer
◇ Monitoring Well Tertiary Volcanics Layer
+ Monitoring Well Jurassic/Cretaceous Granodiorite Layer
☐ Monitoring Well Paleozoic Siltstones Layer
■ Monitoring Well Paleozoic Limestones Layer
Perennial Stream Reach
Stream (Intermittent or Ephemeral)
Discontinuous Flowing Stream Reach (interrupted flow that stops and starts)
Water Level Change in Tertiary Volcanics
Water Level Change in Uppermost Bedrock Due to Pumping
Water Level Change in Quaternary Alluvium/Colluvium
N
0 1 2 Miles

Source: BGMI 2010

Arturo Mine Project EIS

Figure 3.4-5

Changes in Regional Groundwater Elevation (1990 - 2010)

05/24/2012

2012

Table 3.4-4 General Nevada Water Quality Standards

Constituent (mg/l)[1]	Groundwater		Surface Water			
	Nevada Drinking Water Standards		Municipal or Domestic Supply	Nevada Agriculture		Aquatic Life
	Primary MCL[2]	Secondary MCL[2]		Irrigation	Livestock Watering	
Physical Properties						
Dissolved Oxygen	–	–	Aerobic	–	Aerobic	5.0
Color (color units)	–	15[3]	75	–	–	–
Total Dissolved Solids (TDS) (at 180°C)	–	500[4]; 1,000[3]	500[4]; 1,000[3]	–	3,000	–
Turbidity (NTU)	–	–	–	–	–	–
Inorganic Nonmetals						
Ammonia (unionized) (Total NH_3 as N)	–	–	0.5	–	–	–
Chloride	–	250[4]; 400[3]	250[4]; 400[3]	–	1,500	–
Cyanide (as CN)	0.2	–	0.2	–	–	–
Fluoride	4.0	2.0[4]	–	1.0	2.0	0.0052[5]
Nitrate (as N)	10	–	10	–	100	–
Nitrite (as N)	1.0	–	1.0	–	10	–
pH (standard units)	–	6.5-8.5[3]	5.0-9.0	4.5-9.0	6.5-9.0	6.5-9.0
Sulfate	–	250[4]; 500[3]	250[4]; 500[3]	–	–	–
Metals[6]/Elements						
Aluminum	–	0.05[3]-0.2[4]	–	–	–	–
Antimony	0.006	–	0.006	–	–	–
Arsenic (total)	0.01	–	0.01	0.10	0.20	0.18[5,7]
Barium	2.0	–	2.0	–	–	–
Beryllium	0.004	–	–	0.10	–	–
Boron	–	–	–	0.75	5.0	–
Cadmium	0.005	–	0.005	0.01	0.05	0.0006[5,8]
Chromium (total)	0.1	–	0.1	0.10	1.0	0.015[5,8]
Copper	1.3[9]	1.0[3]	–	0.20	0.50	0.0065[5,8]
Iron	–	0.3[4]; 0.6[3]	–	5.0	–	1.0
Lead	0.015[9]	–	0.05	5.0	0.10	0.0004[5,8]
Magnesium	–	125[4]; 150[3]	–	–	–	–
Manganese	–	0.05[4]; 0.1[3]	–	0.2	–	–
Mercury	0.002	–	0.002	–	0.01	0.00012[5]

Table 3.4-4 General Nevada Water Quality Standards

Constituent (mg/l)[1]	Groundwater		Surface Water			
	Nevada Drinking Water Standards		Municipal or Domestic Supply	Nevada Agriculture		Aquatic Life
	Primary MCL[2]	Secondary MCL[2]		Irrigation	Livestock Watering	
Nickel	0.1	–	0.134	0.20	–	0.087[5,8]
Selenium	0.05	–	0.05	0.02	0.05	0.005[5]
Silver	–	0.1[3]	–	–	–	0.0014[5,8]
Thallium	0.002	–	0.013	–	–	–
Zinc	–	5.0[4]	–	2.0	25	0.584[5,8]

[1] Units are milligrams per liter (mg/l) unless otherwise noted.

[2] MCL = Maximum contaminant level. Federal primary standards that existed as of July 1, 2009, are incorporated by reference in NAC 445A.4525.

[3] Nevada secondary MCLs.

[4] Federal secondary MCLs.

[5] 96-hour average.

[6] The standards for metals are expressed as total recoverable unless otherwise noted.

[7] Standard for arsenic (III); trivalent (reduced) inorganic form of arsenic, which occurs as a water soluble form.

[8] Standard is dependent on site-specific hardness; displayed value is based on a hardness of 60 mg/l as calcium carbonate. (See NAC 445A.144 for equations.)

[9] Value is action level for treatment technique for lead and copper.

Sources: 40 Code of Federal Regulations (CFR) 141.51; 40 CFR 143.3; NAC 445A.119, 445A.144, 445A.453, and 445A.455.

TDS concentrations and pH were outside the Class C stream standards at Site AR09. This site is located at the toe of the existing WRDF, on the upgradient side of where water flows into a constructed pond. Investigators indicate it is likely that water at Site AR09 is partially from meteoric sources and also from a previously-existing water source, as indicated by the observed perennial flow (SRK 2010b). Cedar Creek (2009) suggests the water at Site AR09 is spring flow or mine drainage.

TDS concentrations were outside the Class C Stream standards at Site AR17. This sampling location is above the Carlin Formation, and also is in a drainage bottom at the toe of the existing WRDF (Cedar Creek 2009; SRK 2010b). Free water or moist soil was observed at Site AR17 during each sampling event. The elevated TDS concentrations at this location may be due to the generally stagnant conditions.

TDS concentrations and pH were outside the Class C Stream standards at Site AR36. This location is next to the earthen dam on the opposite (downgradient) side of the 2-acre detention pond from Site AR09.

Off-site water quality data are available for Boulder Creek and Antelope Creek as indicated in **Table 3.4-5**. For pH and TDS, sampling data from the BVMP indicate that constituent concentrations in Boulder Creek upgradient and downgradient of the project area were well within the reference Class C receiving water quality standards (BGMI 2010). Site BC-AA is located on Boulder Creek immediately upgradient of the ephemeral channel on which Site AR17 is located (**Figure 3.4-2**). Water quality from BC-AA for these constituents was well within the reference Class C water quality standards during the same sampling period as the project baseline samples.

BVMP Site BC-A is located on Boulder Creek approximately 2.5 miles downgradient of the project area. Similar to the upstream data, the water quality at Site BC-A was well within the reference Class C water quality standards during the same sampling period as the project baseline samples. On upper Antelope

Table 3.4-5 Water Quality Summary for Sampled Surface Drainage Locations within and near the Project Area[1]

Constituent [2]	Stream Standard Reference[3]	Site AR05	Site AR09	Site AR17	Site AR27	Site AR34	Site AR36	Site BC-AA	Site BC-A	Site ANT-1A
Aluminum		<0.080	<0.080	<0.080	3.39	1.58	<0.080 – 0.14	0.85 – 0.859	0.727 – 3.89	0.802
Antimony		0.00572	0.0149 – 0.0229	0.0196 -0.0286	<0.00300	<0.00300	0.0136	<0.003	<0.003	<0.003
Arsenic	0.1 (I)	0.0241	0.0508 – 0.0805	0.0178 – 0.0728	<0.00300	<0.00300	0.0595 – 0.0763	<0.003 – 0.00303	0.00396 – 0.00418	<0.003
Barium		0.0116	0.0421 – 0.105	0.175 – 0.83	0.0674	0.0841	0.0083 – 0.0981	0.0765 – 0.126	0.1990 – 0.346	0.0621
Beryllium	0.1 (I)	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.002	<0.002	<0.002
Boron	0.75 (I)	0.27	0.198 – 0.283	0.119 – 0.144	<0.074	0.09	0.297 – 0.375	<0.04 – 0.041	<0.04 – 0.04	0.051
Cadmium[4]	0.0006 (A)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.002	<0.002	<0.002
Chloride		85	80.8 – 136	48.8 – 79.3	2.27	5.65	142 – 156	2.45 – 3.54	3.68 – 3.86	11.5
Chromium (total)	0.1 (I)	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.006	<0.006	<0.006
Copper[4]	0.0065 (A)	<0.010	<0.010 – 0.011	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01 – 0.01	<0.01
Fluoride	1 (I)	0.891	0.829 – **1.13**	0.712 – 0.822	0.159	0.139	0.831 – 0.974	0.131 – 0.158	0.186	0.303
Iron[4]	1 (A)	<0.060	<0.060	<0.060	**2.03**	0.857	<0.060 – 0.097	0.453 – 0.512	0.458 – 2.78	0.527
Lead[4]	0.0004 (A)	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300	<0.003	<0.003	<0.003
Manganese	0.2 (I)	0.138	<0.0040 – 0.0197	0.0045 – 0.0158	0.0196	0.0102	<0.0040 – 0.0051	0.0134 – 0.016	0.008 – 0.101	0.0631
Mercury[4]	0.00077 (A)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.0002	<0.0002	<0.0002
Nickel[4]	0.087 (A)	<0.010	<0.010 – 0.0221	<0.010	<0.010	<0.010	<0.010	0.01	<0.01	<0.01
Nitrate + Nitrite, Total (as N)		1.38	15.0 – 38.6	14.7 – 42.7	0.0789	0.0996	0.32 – 8.08	<0.02 – <0.25	<0.05 – <0.25	0.236
pH (S.U.)	6.5 – 9.0	8.18	8.09 – **9.38**	8.07 – 8.74	7.45	7.62	**9.03 – 9.67**	7.95 – 8.13	7.81 – 8.1	7.36
Selenium[4]	0.005 (A)	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.003	<0.003	<0.003
Silver		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.005	<0.005	<0.005
Sulfate		157	139 – 186	59.6 – 80.6	9.92	17.8	239 – 262	16.2 – 22.2	181.1 – 31.5	43.2
Thallium		<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.001	<0.001	<0.001
Total Dissolved Solids	≤500 milligrams per liter (mg/l) or 1/3 above that characteristic of natural conditions (whichever is less)	**580**	**560 – 961**	**510 – 650**	182	195	**747 – 862**	151 – 160	136 – 167	153
WAD Cyanide		<0.0100	0.0198 – 0.0702	no data	no data	no data	<0.0100			
Zinc[4]	0.584 (A)	<0.0100	<0.0100	<0.0100	0.0105	<0.0100	<0.0100	<0.01	<0.01 – 0.0331	0.0169

[1] Where more than one sample was analyzed, the range of results is indicated.

[2] Units are milligrams per liter unless otherwise indicated. Bold values exceed reference standards.

[3] For reference only. Indicates the most stringent Class C surface water standard for either irrigation (I), livestock watering (L), or aquatic life (A) in milligrams per liter. The ephemeral reaches of Boulder Creek are not used for municipal/domestic supply. Standards for metals are expressed as total recoverable.

[4] 96-hour average; some are hardness based, where displayed value assumes a hardness of 60 mg/l as $CaCO_3$. Actual hardness (and the resulting stream standard) may differ.

Source: BGMI 2010; SRK 2010b.

Creek, water quality from Site ANT-1A was well within the reference Class C water quality standards for the constituents of interest. This site is upgradient of any potential project effects, and indicates that background water quality is within reference stream standards.

Data from these sites on Boulder and Antelope creeks indicate that, although TDS and/or pH levels were elevated in the project area, off-site conditions for these constituents were not elevated above the reference Class C water quality standards. On-site baseline exceedences at AR09, AR17, and AR36 do not appear to have generated concentrations above the Class C reference values in Boulder Creek. This may result from a combination of factors, including the impounded nature of the AR09 and AR36 locations, limited flow durations in the project-area tributaries, seepage into channel beds, and dilution from other tributaries to Boulder Creek.

Groundwater Quality

Groundwater quality in the region is based on sampling conducted for the original Betze Project EIS (BLM 1991a,b) and from 61 wells sampled as part of the Betze-Screamer Pit Lake Study (Radian International and Baker Consultants 1997). In addition, 36 regional wells were selected to characterize the groundwater in the Boulder Valley alluvium and Tertiary volcanics (BLM 2000b,c). The Betze Pit Expansion Project, Draft Supplemental EIS Appendix B, (BLM 2008b) presents the general groundwater chemistry for the major hydrostratigraphic units in the region.

There are three main hydrostratigraphic units that occur within the proposed project area and are exposed in the existing open pit and that would be exposed in the proposed pit expansion: 1) marine carbonate rocks; 2) marine clastic rocks; and 3) older basin fill deposits (i.e., Carlin Formation). The marine carbonate rocks contain a strong calcium-bicarbonate water type that is relatively low in sodium and sulfate; average TDS are approximately 566 mg/l, and average pH is around 6.7 standard units. The marine clastic rocks in the region primarily contain calcium-magnesium-bicarbonate water with elevated sulfate and silica. The average TDS in this water are approximately 305 mg/l, and pH is approximately 7.6 standard units. The older basin fill contains a calcium-bicarbonate water with silica and sulfate; average TDS are approximately 478 mg/l, and average pH is approximately 7.4 standard units.

3.4.1.4 Rock Geochemistry

Mining operations bring mineralized rocks from depth, where they are geochemically stable, to the surface, where they are exposed to air and water and are subject to weathering reactions. Sulfide minerals, in particular, undergo oxidation reactions resulting in acid sulfate and metal-bearing solutions that could potentially affect surface and groundwater resources. The potential of mined rock to affect contact water within the proposed project area is assessed in two principal ways: by determining acid rock drainage risk and metal leaching risk (SRK 2009a).

A series of standard geochemical tests were conducted with rock material from the proposed open-pit mine expansion area, the future and existing mine pit surface areas, and existing WRDF to evaluate the potential for future releases of metals and other solutes. These tests include acid-base accounting, static testing, net-acid generation (NAG), pH tests, kinetic testing (humidity cells), and meteoric water mobility procedures (MWMP). Two hundred twenty-five waste rock samples were tested. **Table 3.4-6** shows the number of samples per each waste rock type.

Waste Rock Characterization

The proposed project would generate approximately 600 million tons of waste rock material that would be placed in the West WRDF and East WRDF. The waste rock material generated during mining consists of the following:

- Carlin Formation (35.9 percent of the projected waste rock tonnage), which is composed of unmineralized silt and clay. It has no potential for acid generation.

- Vinini Formation (37.6 percent of the waste rock tonnage), which consists of interbedded siltstones and cherts. The Vinini is generally oxidized throughout the proposed project area. Vinini rocks are siliceous, have a low acid neutralizing potential (ANP), and have variable but generally low levels of sulfide sulfur. A small fraction of Vinini rocks may have the ability to form acidic conditions upon weathering, and silicic portions of the Vinini may release metals at neutral pH levels.
- Rodeo Creek Unit (19.4 percent of the waste rock tonnage), which is a siltstone containing approximately 8 percent carbonate minerals. Approximately 44 percent of the Rodeo Creek unit materials are oxidized and 56 percent are unoxidized. The abundance of sulfur varies according to the oxidation status. Oxidized rock generally has no detectable sulfide sulfur (except rarely near transition zones). Unoxidized rock averaged 0.9 percent total sulfur in available test work, but only a minority of these samples (9 of 23, or 39 percent) (SRK 2009a) had more acid generation potential (AGP) than ANP. Overall, sulfide-containing Rodeo Creek material comprises approximately 11 percent of the waste rock. Approximately 25 percent of the sulfide Rodeo Creek unit is acid-generating, while 75 percent is expected to remain neutral (SRK 2009a).
- Bootstrap limestone (2.3 percent of waste rock). Based on the analytical results, approximately 43 percent of the Bootstrap limestone material contains sulfide; however, the calcite in the limestone makes acid generation unlikely.

Acid-base Accounting Tests

Acid-base accounting (static testing) is based on determinations of the AGP, which is a function of the amount of sulfide minerals in a rock, and the ANP, which is a function of the amount of carbonate minerals in a rock. The ANP and AGP are expressed in terms of kilograms of calcium carbonate per ton of sample (kg/t). The difference between the ANP and AGP is the net-neutralizing potential (NNP).

For purposes of assessing acid rock drainage risk, rocks within the proposed project area were assumed to be potentially acid generating (PAG) if the NNP was less than 0, and pyritic sulfur exceeded 0.1 percent. Sulfide values below 0.1 percent rarely result in acid generation (SRK 2009a). Fifteen of the 225 samples tested were PAG according to the above criteria. (**Table 3.4-6**).

Table 3.4-6 Acid-based Accounting Test Results Summary for Waste Rock to be Placed in the WRDFs

Rock Type	Number of Samples	NNP (kg/t)	AGP (kg/t)	ANP (kg/t)	ANP/AGP Ratio	NAG/pH (s.u.)[1]	Paste pH (s.u.)	PAG (%)
Carlin Formation	19	6.7	0.3	7.1	24	7.4	7.8	0
Vinini Formation	102	40.9	1.0	42.0	42	6.6	8.2	3.9
Bootstrap Oxide	13	560.8	0.7	561.5	802	8.0	8.2	0
Bootstrap Sulfide	17	869.8	0.3	870.1	2,900	8.1	8.6	0
Rodeo Creek Oxide	27	140.7	2.6	143.3	55	7.4	8.2	0
Rodeo Creek Sulfide	47	96.2	24.4	120.6	5	6.5	7.7	23.4
Expansion Area (average value)		**154.2**	**6.0**	**160.2**	**27**	**6.9**	**8.1**	**4.0**

[1] s.u. - standard unit

Source: Schafer 2011a; SRK 2009a.

The ratio of ANP to AGP can also be used to access the acid generation potential. If the ratio of the neutralization potential is 1:1(or less), the material is more likely to generate acid; whereas, if the ratio is 3:1 (or greater), the material is unlikely to generate acid (U.S. Environmental Protection Agency [USEPA] 1994). The average ANP/AGP ratio for all of the rock units tested ranged from 5:1 to 2,900:1. The average ANP of all samples tested was 160.2 kg/t, while the average AGP was 6.0 kg/t, for an average NNP of 154.2 kg/t and an ANP/AGP ratio of approximately 27:1 (SRK 2009a).

The NAG pH testing consists of the addition of hydrogen peroxide, a strong oxidant, to a sample to accelerate the reaction of sulfides. If the acidity liberated through sulfide oxidation is not neutralized, the resultant acidic pH indicates a PAG sample. Twenty of the 225 NAG pH tests were PAG, including 15 of 47 Rodeo Creek sulfide samples and 5 of 102 Vinini samples. NAG test results are shown in **Table 3.4-6**.

Kinetic Testing

Kinetic testing, consisting of humidity cell testing, is designed to represent maximum rates of acid generation and metals released from rocks caused by intense weathering. The information obtained from these tests is used in geochemical modeling to represent the rate of solute release from pit rock into pit lakes and to evaluate waste rock for disposal alternatives.

Humidity cell tests were conducted for 52 weeks on six samples that varied in NNP from -31 to +943 kg/t. Samples tested in humidity cells represented rocks most likely to react and form acid, being selected mostly from unoxidized (sulfide) zones that had elevated pyritic sulfur levels. Two of the six samples became strongly acidic over the period of testing. Acid generation was accompanied by high concentrations of trace metals. The samples that did not become acidic showed low concentrations of trace metals.

Constituent mobility potential tests were conducted on Carlin and Vinni Formation materials to assess the potential mobility from the solids by contact with meteoric water (McClelland Laboratories, Inc. 2010). These tests were conducted for a duration of 10 weeks in 7-day cycles. In brief, the testing method consisted of placing composites of crushed rock material (~3/8 inch or less) in columns and applying deionized water to the top of the column at a constant rate for 5 days and then allowing the column to free drain for 2 days. Each week, the pH, EC, and acidity and alkalinity of effluent was analyzed. The effluent collected at the end of weeks 2, 4, 6, 8, and 10 were submitted for laboratory analysis to evaluate the pH and release of metals within the effluent. The results indicate that the pH of the effluent over the 10 week duration of the test was neutral ranging from pH 7.44 to 8.31. These tests indicate that the composite samples of Carlin and Vinini Formation materials did not generate acid or release elevated concentrations of metals.

Meteoric Water Mobility Procedure Testing

MWMP testing simulates conditions under which infiltrating precipitation (rainwater and snowmelt) may leach constituents present in the waste rock. MWMP tests were conducted on 89 samples, including 40 samples of Rodeo Creek (24 sulfide), 14 samples of Bootstrap (6 sulfide), 33 samples of Vinini, and 2 samples of Carlin. The vast majority of project samples would be expected to have solution with high pH and low metals, but a small fraction of the higher sulfide Rodeo Creek samples may develop low to moderate pH and moderate to high metals (SRK 2009a).

The MWMP tests also reflected the typical Carlin Trend geochemical signature of elevated arsenic, antimony, and mercury with alkaline samples ranging from 0.002 to 0.2 mg/l soluble arsenic and antimony. Antimony levels generally were equal to arsenic, which is uncommon. More commonly, arsenic is more abundant in solution than antimony by a factor of 3 to 10. Most samples had no detectable mercury (<0.0002 mg/l), but a few Rodeo Creek samples had mercury from 0.001 to 0.008 mg/l.

In addition to information presented for numerous samples in Appendix A of the PoO, MWMP constituent analyses are available from the project area for representative material samples from the Carlin Formation, the Vinini Formation, Rodeo Creek waste rock materials, and surface soils (McClelland Laboratories 2010). These sample results are summarized in **Table 3.4-7**

Table 3.4-7 Meteoric Water Mobility Results for Representative Material Sources

Constituent [1]	Nevada Drinking Water Standards [2]	Carlin	Vinini	Rodeo Cr Sulfide, PAG [7]	Rodeo Cr Sulfide, Non-PAG	Rodeo Creek Oxide	Surface Soil
Aluminum	0.05[4] – 0.2[5]	1.84	0.141	<0.080	<0.080	<0.080	0.297
Antimony	0.006	<0.0030	0.00492	1.67	0.0231	0.00421	<0.0030
Arsenic	0.01	0.00806	0.0138	0.0243	0.0151	0.00569	0.0268
Barium	2.0	0.0998	0.0814	0.0183	0.0508	0.0333	0.106
Beryllium	–	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron	–	0.079	0.111	0.167	0.087	0.153	0.207
Cadmium	0.005	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020
Calcium	–	19.4	28.6	371	67.6	109	42.7
Chloride	250[3], 400[4]	–	–	–	–	–	–
Chromium (total)	0.1	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060
Copper	1.3[6], 1.0[5]	<0.010	0.011	<0.010	<0.010	<0.010	<0.010
Fluoride	2.0[4], 4.0[5]	–	–	–	–	–	–
Iron	0.3[4], 0.6[5]	0.683	<0.060	<0.060	<0.060	<0.060	0.111
Lead	0.015[6]	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Magnesium	125[4], 150[5]	3.74	6.94	39.2	38.6	43.2	10.6
Manganese	0.05[4], 0.1[5]	0.0178	0.0114	4.25	0.0419	0.0231	<0.0040
Mercury	0.002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	–	0.0252	0.0662	0.784	1.26	0.204	0.0221
Nickel	0.1	<0.010	<0.010	0.286	0.014	<0.010	<0.010
Nitrate N	10	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
pH, Extraction Fluid	–	5.61	5.61	5.61	5.61	5.61	5.61
pH, Leachate	6.5 – 8.5[3]	8.00	8.09	7.74	8.26	8.03	8.17
Potassium	–	–	–	–	–	–	–
Selenium	0.05	<0.0030	0.0221	0.240	0.143	0.0266	0.00488
Silver	0.1[5]	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	–	37.4	20.4	11.1	35.5	46.1	103

Table 3.4-7 Meteoric Water Mobility Results for Representative Material Sources

Constituent [1]	Nevada Drinking Water Standards [2]	Carlin	Vinini	Rodeo Cr Sulfide, PAG [7]	Rodeo Cr Sulfide, Non-PAG	Rodeo Creek Oxide	Surface Soil
Thallium	0.002	<0.0010	<0.0010	0.00206	<0.0010	<0.0010	<0.0010
TDS	500[4], 1,000[5]	230	190	1700	580	800	520
Vanadium	–	0.0091	0.0079	<0.0050	0.0063	<0.0050	0.0359
Zinc	5.0[5]	<0.010	<0.010	0.0933	<0.010	<0.010	<0.010

[1] Values in milligrams per liter, except for pH in standard units.

[2] Nevada primary MCLs unless otherwise noted.

[3] Source: Appendix B, BLM 2008b.

[4] Federal secondary MCLs.

[5] Nevada secondary MCLs.

[6] Value is action level for treatment technique for lead and copper.

[7] Potentially Acid Generating

Source: McCelland Laboratories, Inc. 2010.

As reported in **Table 3.4-7**, many of the MWMP analyses for constituents of interest have concentrations below their reporting limits. These constituents include beryllium, cadmium, chromium, most copper analyses, lead, mercury, silver, and most thallium and zinc results. Thallium results in the Rodeo Creek PAG material are borderline to the primary MCL for drinking water. TDS values in MWMP analyses exceed the secondary MCL for drinking water in Rodeo Creek materials. Barium, leachate pH, zinc, and most other results are well within Nevada water quality standards (**Table 3.4-4**).

As mentioned above, some constituents of primary interest in the region include antimony, arsenic, and mercury. Antimony concentrations are elevated in MWMP results for the Rodeo Creek sulfide materials. Arsenic MWMP values in several materials are elevated above the primary MCL for drinking water, but are within surface water standards (**Table 3.4-4**). Mercury concentrations are all below reporting limits in the samples reported above in MWMP analyses. Selenium concentrations also are of interest to surface water uses. Selenium concentrations exceed the MCL for drinking water in the Rodeo Creek sulfide materials, and exceed aquatic life standards in the Vinini and Rodeo Creek materials. Potential impacts to water quality are summarized in Section 3.4.2, Environmental Consequences.

Existing Waste Rock Material

The historic Dee Mine operated from 1984 to 2000, resulting in the placement of waste rock in the existing WRDF of which a portion would be incorporated into the proposed pit expansion area. The previously placed waste rock was mostly oxidized, which is confirmed by test results from 44 samples collected during the life of the mine. All samples had NNP values greater than 0, and only 8 samples had AGP greater than 5 kg/t. The average NNP of historic samples was 187 kg/t, while the average AGP was 2.6 kg/t (SRK 2009a).

Pit Wall Rock Characterization

Rocks exposed in the existing Dee open pit and would be exposed in the proposed pit expansion include a thick wedge of Carlin Formation, oxidized Vinini Formation, and oxidized and unoxidized Rodeo Creek and Bootstrap Formation rocks (**Table 3.4-8**).

Table 3.4-8 Average NNP of Rock Materials Exposed in the Pit Walls in the Existing and Proposed Open Pit

Rock Type	Existing Dee OpenPit			Proposed Pit Expansion		
	Pit Surface (%)	PAG (%)	Average NNP (kg/t)	Pit Surface (%)	PAG (%)	Average NNP (kg/t)
Old Dump Fill - Mostly Vinini	10.60	0.00	39.3	2.00	0.00	39.3
Carlin Formation	18.20	0.00	19.1	28.20	0.00	19.1
Vinini Formation - Oxide	35.20	3.9	39.3	30.80	3.90	39.3
Rodeo Creek - Oxide	20.70	0.00	129.8	10.30	0.00	129.3
Rodeo Creek - Sulfide	1.60	23.40	-	16.10	23.40	-
Bootstrap Oxide	7.70	0.00	591.2	5.60	0.00	591.2
Bootstrap Sulfide	5.90	0.00	857.7	6.90	0.00	857.7
Total	**100.00**	**1.80**	**145.9**	**100.00**	**5.00**	**137.2**

Source: Schafer 2012a.

The Carlin Formation comprises approximately 18.2 percent of the existing Dee open pit surface and 28.2 percent of the future pit surface. The Carlin Formation postdates mineralization and ore deposition and as a result does not contain sulfides or significant amounts of sulfur, and is geochemically inert (SRK 2009a).

The Vinini Formation accounts for 35.2 percent of the rock exposed in the existing Dee open pit surface and 30.8 percent of the proposed pit surface. Backfilled waste rock (mostly Vinini material) also covers 10.6 percent of the existing pit and 2.0 percent of the proposed pit surface. A small fraction (less than 4 percent) of Vinini rocks may have the ability to form acidic conditions upon weathering, and silicic portions of the Vinini may release metals at neutral pH levels.

The Rodeo Creek unit accounts for most of the remaining pit surface area. It is a siltstone containing approximately 8 percent carbonate. Its geochemical behavior depends on whether or not it has been oxidized. Oxidized Rodeo Creek material contains very little sulfide sulfur and is not potentially acid generating. Oxidized Rodeo Creek material accounts for 20.7 percent of the existing exposed pit surface and 10.3 percent of the proposed pit expansion surface. Unoxidized Rodeo Creek material contains an average of 0.9 percent sulfide sulfur. Twenty-four percent (24 percent) of the unoxidized Rodeo Creek samples had more AGP than ANP. Unoxidized Rodeo Creek material is exposed in 1.6 percent of the existing pit surface and would be exposed in 16.1 percent of the proposed open-pit expansion. Unoxidized Rodeo Creek Unit rocks exposed in the pits is potentially acid-generating material.

The last rock type in the existing Dee open pit is the Bootstrap limestone, which also is the primary ore host. The Bootstrap accounts for 13.6 percent of the rock exposed in the current Dee highwall and 12.5 percent of the future pit surface.

3.4.1.5 Water Rights

An inventory of active water rights in the region surrounding the proposed project was used to identify the location and status of water rights within potentially affected areas. The inventory was based on water rights records on file with the NDWR. The inventory identified all active water rights located within the vicinity of the proposed project. For the purpose of the EIS analysis, all groundwater rights owned by BGMI and Cordex Exploration Company that historically conducted exploration activities at the project site, were excluded from this summary. The locations of the points of diversion for the identified water rights in the project vicinity are shown in **Figure 3.4-6**; the owners, beneficial use, and annual duty for each water right are summarized in **Table 3.4-9**. Based on the NDWR database, there are a total of seven active water rights in the inventoried area, which includes one surface water right and six groundwater rights. The only identified surface water right is a spring used for stock watering. No public reserve water rights under the 1926 Executive Order, Public Water Reserve No. 107 were identified in the database within the inventoried area. All other water rights are groundwater rights used for mining.

3.4.2 Environmental Consequences

The primary issues related to water resources include: 1) impacts to groundwater and surface water quality from the construction, operation, and closure of heap leach facilities, waste rock storage facilities, and other mining and processing facilities; 2) impacts from flooding, erosion, and sedimentation associated with mine construction, operation, or closure activities; and 3) impacts related to the water quality of the post-mining pit lakes.

Table 3.4-9 Active Water Rights Located in the Vicinity of the Proposed Project

Map ID	Application	Certificate	Status	Source	Type of Use	Annual Duty (afy)[1]	Owner of Record
1	17233	5729	Certificate	Underground	Mining-Milling	0.0	Newmont Gold Company
2	26728	9940	Certificate	Underground	Mining-Milling	199.5	Newmont Gold Company
3	42931	15356	Certificate	Underground	Mining-Milling	724.0	Baroid Division
4	61410	15359	Certificate	Underground	Mining-Milling	565.0	Baroid Drilling Fluids, Inc.
5	62578		Permit	Underground	Mining-Milling	1,448.0	Meridian Gold Company
6	62579		Permit	Underground	Mining-Milling	1,448.0	Meridian Gold Company
7	V06236		Vested	Spring	Stock Watering	0.0	26 Ranch Inc. (Spg #5)

[1] acre feet per year (afy).

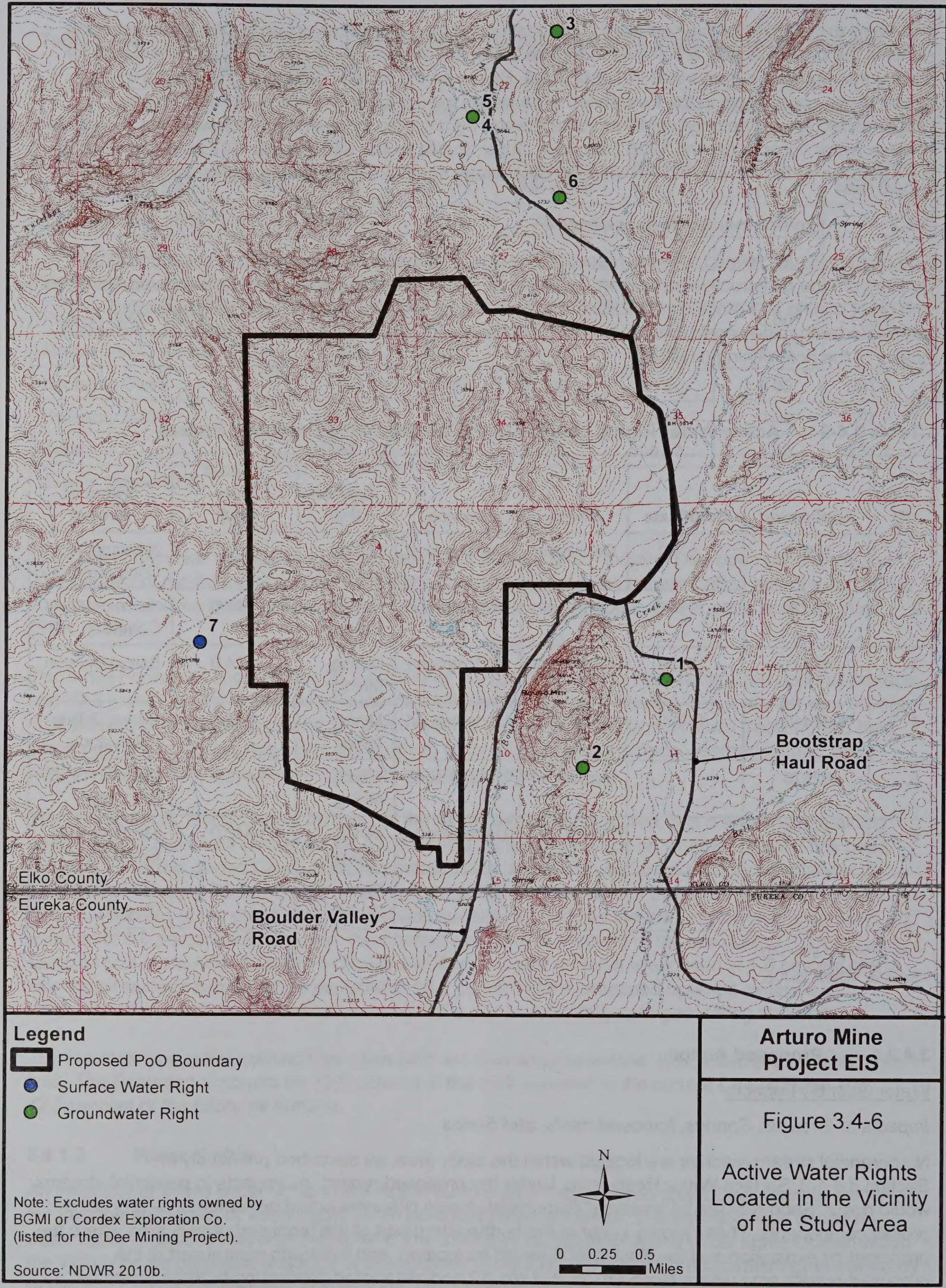
Source: NDWR 2010b.

3.4.2.1 Proposed Action

Water Quantity Impacts

Impacts to Streams, Springs, Impoundments, and Seeps

No perennial stream reaches are located within the study area, as described previously in Section 3.4.1.2, Surface Water Resources. Under the proposed project, no impacts to perennial streams would occur. Short reaches of unnamed ephemeral stream channels would be removed by proposed project components. These mostly occur in the northeastern part of the proposed project area where the proposed pit expansion and the East WRDF would be located, and the south central part of the proposed project area where Heap Leach Pad No. 12 and associated processing facilities would be



Note: Excludes water rights owned by BGMI or Cordex Exploration Co. (listed for the Dee Mining Project).

Source: NDWR 2010b.

Arturo Mine Project EIS

Figure 3.4-6

Active Water Rights Located in the Vicinity of the Study Area

05/16/2012

located. At the proposed East WRDF, a small ephemeral watershed occupying approximately 360 acres would be affected. Additional ephemeral drainage headwaters would be covered in Section 33 by the West WRDF. The watershed area that would be disturbed by the West WRDF in the northwest corner of the proposed project area, which occupies approximately 240 acres in its undisturbed condition, and contributes only ephemeral flow to Antelope Creek, a tributary of Rock Creek. In the south, the ephemeral drainage is already controlled by existing storm water diversions.

For all of these drainages, runoff from contributing upgradient watersheds would be diverted around the proposed components or contained as described in Chapter 2.0 of the proposed PoO (SRK 2009a). Accepted engineering practices, including diversion ditches, sediment traps, small containment structures, or other Best Management Practices (BMPs) would be implemented to comply with Nevada storm water management practices for the mining industry.

Based on the lack of perennial stream reaches, the relatively small ephemeral drainages involved, and the proposed storm water management approach, direct impacts to stream flows in Boulder Creek would be of minimal consequence and local in nature.

Drainage Area Considerations

The hydrologic study area occupies approximately 47,360 acres (74 square miles). At monitoring location BC-AA (**Figure 3.4-2**), the upper Boulder Creek watershed area is approximately 17,537 acres (27.4 square miles). Further downstream at monitoring location BC-A, the Boulder Creek watershed area is approximately 47,913 acres (approximately 75 square miles). The removal or re-routing of basin areas for the proposed project would affect the contributing watershed area of upper Boulder Creek. Under existing conditions, approximately 513 acres of disturbance do not drain to the watershed. This acreage includes existing project components such as heap leach pads, tailings disposal facilities, the open pit, and associated isolated drainages. Under the Proposed Action, approximately 1,626 acres of contributing watershed area would be removed from the upper Boulder Creek drainage in the post-mining topographic configuration. This would be an increase in restricted drainage of approximately 1,113 acres from the existing condition in upper Boulder Creek. Overall, the Proposed Action would restrict watershed contributions from approximately 3.4 percent of the approximately 47,360-acre hydrologic study area. Restricted drainage from the Proposed Action would represent approximately 0.45 percent of the 560 square miles of watershed in Boulder Flat (Hydrographic Basin 61).

In the Antelope Creek watershed (which is part of the Rock Creek Valley hydrographic basin 62), approximately 292 acres of the proposed West WRDF would drain to small ephemeral tributaries. These channels run a distance of about one to 1.5 miles from the proposed WRDF footprint to Antelope Creek itself. In addition to the western slopes of the West WRDF, this acreage estimate assumes that a portion of the WRDF would drain westward to the Antelope Creek watershed during high runoff events. At its mouth at the connection with Rock Creek, the overall Antelope Creek watershed occupies approximately 144.4 square miles (92,416 acres), or about one-third of the Rock Creek Valley hydrographic basin. The watershed area affected by the proposed WRDF would represent approximately 0.3 percent of the Antelope Creek drainage and about 0.1 percent of the Rock Creek Valley Hydrographic Basin.

The areas that would be affected by the Proposed Action are drained in the project area by ephemeral streams. The impacts of drainage modifications on flow quantities in Boulder Creek or Antelope Creek would probably not be measurable.

The existing impoundments in the proposed project area described in Section 3.4.1.2, Surface Water Resources, and shown in **Figure 2-3** would not be removed by the proposed project. Direct disturbance to these features by the proposed project footprint would be avoided. Potential water quality impacts to these features are discussed below in the water quality assessment. Upgradient watershed areas that contribute to the ponds would be disturbed primarily by the southern part of the West WRDF and ancillary features on the north side of proposed Heap Leach Pad No. 12. Topographic modifications and storm water control features would reduce the contributing watershed area for the upgradient small pond. This temporarily may reduce the amount of runoff stored in that pond (or routed to the lower pond) until recontouring and reclamation are completed as proposed. Water would still collect in both ponds, since the West WRDF would be reclaimed as the proposed project proceeds, and some existing contributing drainage area would not be incrementally disturbed. However, the extent of open water habitat and fringing wetlands may be somewhat reduced. No springs would be removed by the proposed project. Seeps and non-jurisdictional wetlands would be incrementally removed either by burial under proposed project components or by removal of water sources adjacent to the proposed pit expansion. The seeps and springs identified within the proposed project area and nearby locations are indicated in **Figure 3.4-2**. Based on inventories (Cedar Creek 2009) and comparison of the existing and authorized disturbance footprint to the proposed project (**Figure 3.4-2**), the following 12 seep features would be incrementally removed:

- AR01, AR02, AR03, and AR04 are seeps in the middle of Section 3, Township 36 North, Range 49 East, that would be removed or drained by the proposed open pit expansion.
- AR10, AR11, AR12, AR13, AR14, and AR15 are seeps or catchments (such as remnant collection ponds or basins constructed during mining operations) that would be buried or otherwise removed by construction of the West WRDF or Heap Leach Number 12.
- AR17 and AR19 are, respectively, a drainage bottom wetland with open water and a seep area dominated by crested wheatgrass (Cedar Creek 2009).

These impacts would minimally affect surface water or groundwater resources, and would primarily involve habitat effects.

Potential impacts to floodplains and flood hydrology from the proposed project would be minimal. No federally delineated flood hazard zones have been identified within the proposed project area, and drainageways consist of narrow ephemerals. Storm water drainage ditches and small catchments would be constructed to manage runoff according to the Nevada Division Department of Environmental Protection (NDEP) and BLM requirements.

Impacts to Water Rights

Potential impacts to the water rights identified in **Table 3.4-9** are not anticipated. There are no surface water rights identified within the proposed project area. The proposed project is not expected to result in measurable effects to water levels in the regional aquifer associated with the groundwater rights.

Impacts to Water Levels

As described in Section 3.4.1.3, Groundwater Resources, the depth to groundwater beneath the study area is controlled by dewatering at the BGMI facility. Mine dewatering activities at the BGMI facility have resulted in lowering the groundwater levels approximately 1,700 feet within an approximately 2.5-mile-wide, northwest-trending zone that extends from the Betze/Post Pit to near the center of the proposed project area (**Figure 3.4-5**). Therefore, mine dewatering would not be required for the proposed project, except as necessary to control localized perched groundwater that may be encountered in the Carlin Formation during open-pit mining. Water captured during open-pit mining would be used on site for dust suppression, processing, or evaporated.

The estimated average water requirement for the proposed project is 1,120 afy (700 gpm). This water would be supplied by pumping groundwater from existing or new wells. The most likely target for the groundwater development would be the carbonate aquifer. The current maintenance pumping rate at the BGMI facility to sustain water levels at the 3,576-foot amsl level is approximately 15,000 gpm. The pumping rate required to maintain the drawdown varies within a few hundred gpm from quarter to quarter but has remained relatively constant over the past several years. (For example, in the fourth quarter of 2009 the average pumping rate was 15, 310 gpm; and in the first quarter of 2010 the average pumping rate was 15,880 gpm [BGMI 2010]). Considering the extremely high transmissivity of the carbonate aquifer (JSA 2010a) and flat hydraulic gradient between the Betze Pit to the proposed project area, pumping required for the proposed project from the carbonate aquifer likely would be offset by an equivalent reduction in pumping from the same aquifer at the BGMI facility. Consequently, pumping required for the proposed project is unlikely to result in additional drawdown in the carbonate aquifer over that which was previously predicted and analyzed for the BGMI facility (BLM 2008b, 2000c).

After dewatering ceases at the BMGI facility, the groundwater levels in the carbonate aquifer would rise above the bottom of the proposed open pit and result in the development of three separate pit lakes in the West, South, and East Pits. The estimated timeframe for development and predicted water quality of the pit lakes is discussed in the "Water Quality Impacts" section below.

Water Quality Impacts

Pit Lake Water Quality Evaluation

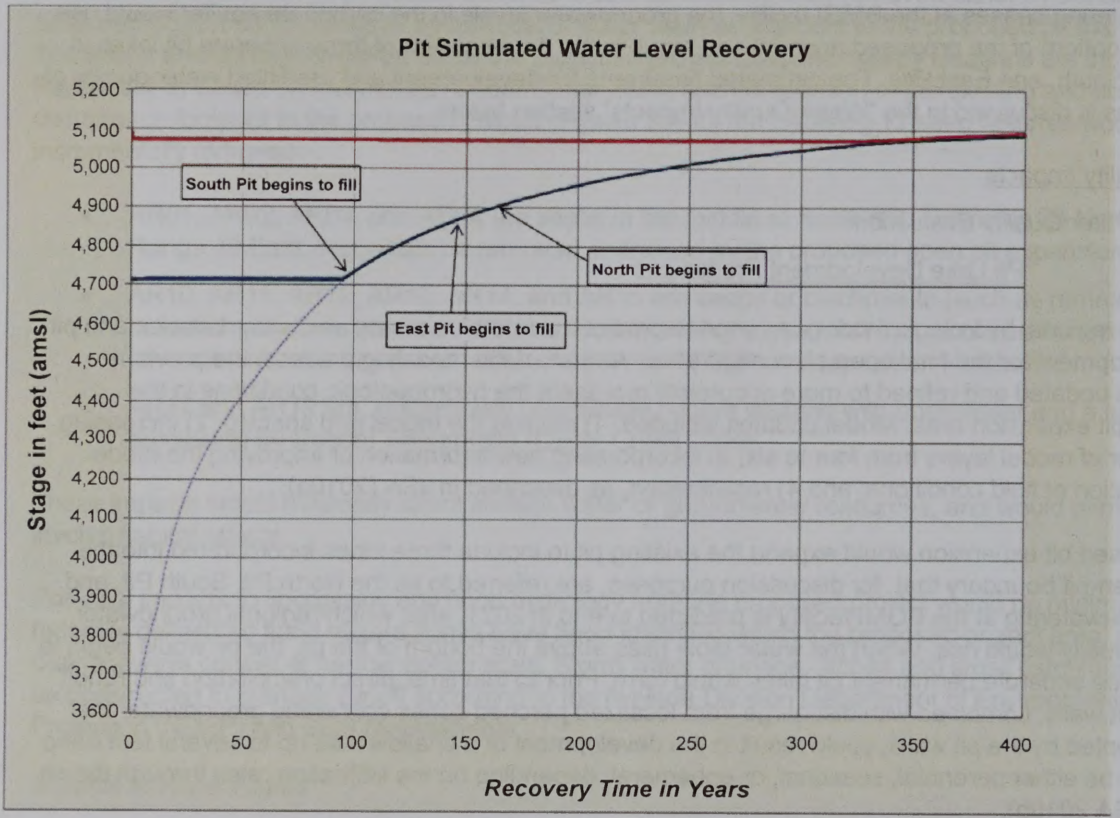
Pit Lake Development Predictions

The BGMI regional hydrologic model was used to predict the rate of recovery and water balance and pit lake development for the final open-pit configuration. As part of the modeling process, the previous model was updated and refined to more accurately represent the hydrogeologic conditions in the proposed pit expansion area. Model updates included: 1) refining the model grid spacing; 2) increasing the number of model layers from four to six; 3) incorporating new information or improving the model representation of field conditions; and 4) recalibration, as described in JSA (2010a).

The proposed pit expansion would expand the existing pit to include three lobes incorporated into the overall open-pit boundary that, for discussion purposes, are referred to as the North Pit, South Pit, and East Pit. Dewatering at the BGMI facility is predicted to end in 2021, after which regional groundwater levels gradually would rise. When the water table rises above the bottom of the pit, the pit would begin to fill, and three separate permanent pit lakes would form. Prior to that time, direct precipitation and runoff from the pit walls, combined with discharge from localized perched zones containing groundwater that are intercepted by the pit walls, could result in the development of a shallow lake up to several feet deep that would be either perennial, seasonal, or ephemeral, depending on the infiltration rates through the pit bottom (JSA 2010b).

The elevation of the water surface in the pit lake over time and the final water level is dependent primarily on the water level recovery in the carbonate aquifer. Because of the high transmissivity of the carbonate aquifer, and the hydraulic interconnection between the three pit lakes, the water levels in each of the pit lakes are predicted to be the same. The model-simulated recovery of groundwater levels and development of the pit lakes is shown in **Figure 3.4-7**. The South Pit would begin to form first after approximately 100 years, followed by the East Pit at Year 150, and finally the North Pit at Year 170. Water levels in all three pits would then rise at the same rate (determined by the recovery curve for the carbonate aquifer) until a steady state was reached, after approximately 400 years. The final pit lake area is illustrated in **Figure 3.4-8**; predicted surface area, volume, and depth from each of the pit lakes are summarized in **Table 3.4-10**.

The model predicts that during the early stages of recovery, local water tables would develop in the Carlin and Vinini formations that represent perched groundwater systems above the carbonate aquifer system. During the first 110 years, runoff and groundwater inflow from perched aquifer zones intercepted in the pit would be discharged primarily as groundwater infiltration to the carbonate aquifer. Between approximately 110 and 200 years, the amount of pit water discharged gradually would be reduced as the lake volume and surface area increase and the amount of water lost through evaporation increases. After approximately 200 years of recovery, the pit lakes are expected to behave as a strong sink (i.e., hydrologic capture zone where there is groundwater inflow that is lost to evaporation but no outflow to the groundwater system) (JSA 2010b).



Legend

- ┈┈ Regional Aquifer Water Level
- ─── Proposed Arturo Pit
- ─── Existing Dee Pit

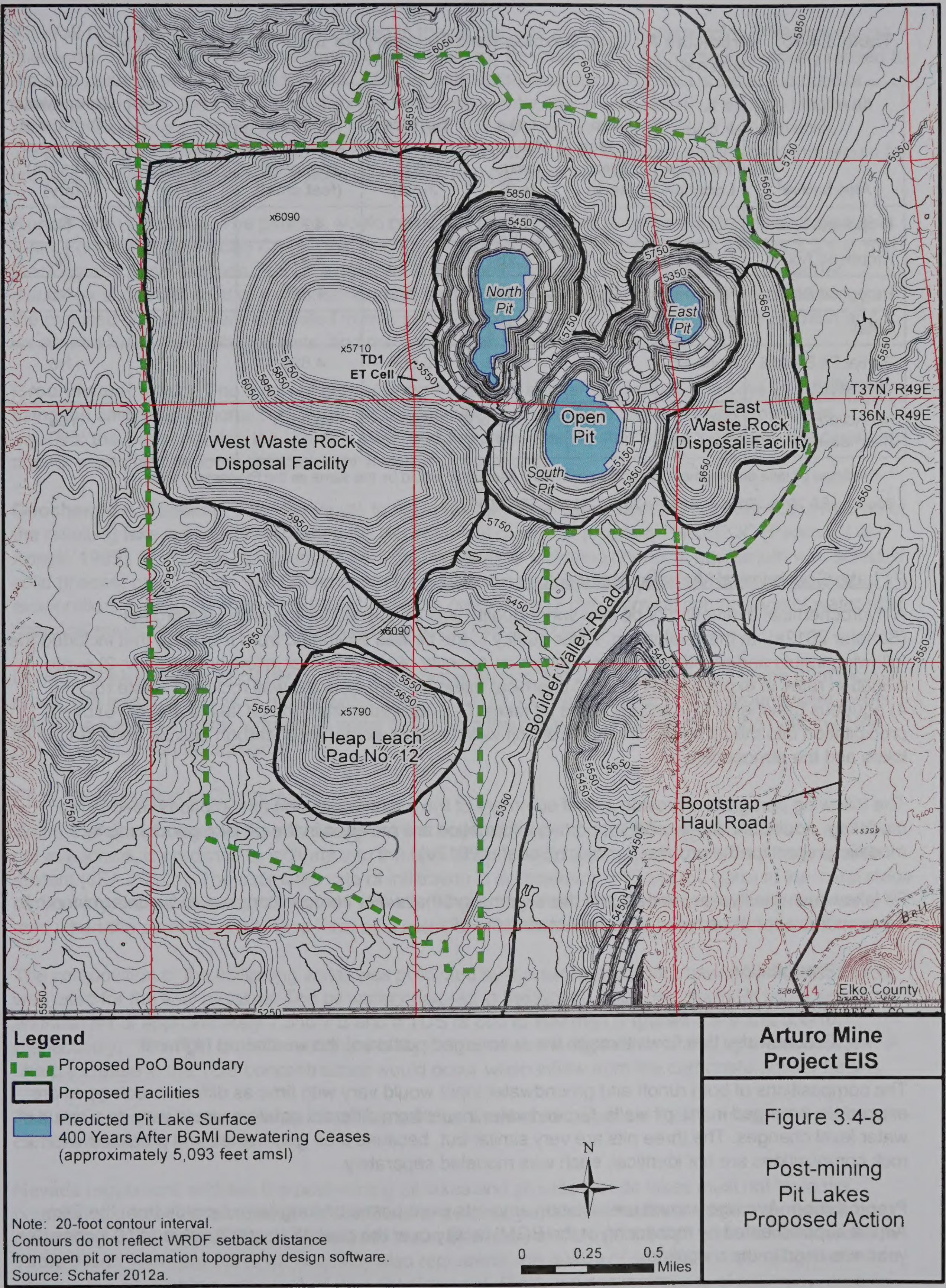
Source: Schafer 2012a.

Dee Arturo Expansion Project

Figure 3.4-7

Comparison of Predicted Rate of Filling for the Existing Dee Pit and the Proposed Arturo Pit

05/16/2012



Legend

🟩 Proposed PoO Boundary

☐ Proposed Facilities

🟦 Predicted Pit Lake Surface 400 Years After BGMI Dewatering Ceases (approximately 5,093 feet amsl)

Note: 20-foot contour interval.
Contours do not reflect WRDF setback distance from open pit or reclamation topography design software.
Source: Schafer 2012a.

Arturo Mine Project EIS

Figure 3.4-8

Post-mining Pit Lakes Proposed Action

8/21/2012

Table 3.4-10 Predicted Pit Lake Development Summary for the Proposed Action and Alternatives

Alternative[1]	Pit Lake Location	Lake Surface Area (acre)	Lake Volume (acre-feet)	Lake Surface Elevation (feet amsl)	Pit Floor Elevation (deepest) (feet amsl)	Maximum Depth (feet)	Groundwater Outflow at 400 years (Yes/No) (afy)
Proposed Action	South Pit	41.9	5,411	5,093	4,730	363	No
Proposed Action	East Pit	27.3	2,281	5,093	4,910	183	No
Proposed Action	North Pit	19.9	2,478	5,093	4,890	203	No
Total		**89.1**	**10,170**				
Partial Pit Backfill Alternative	North Pit	19.9	2,663	5,093	4,890	203	No
No Action Alternative	Dee Open Pit	0.6	6.5	5,093	5,053	40	Yes

[1] Predicted pit lake development for the Single WRDF Alternative would be the same as the Proposed Action.

Source: JSA 2011, 2010b,c; Schafer 2012a, 2011d; SRK 2012.

Pit Lake Geochemical Modeling Methodology

A hydrochemical evaluation of pit lake water quality was performed for the proposed project (Schafer 2012a). In this evaluation, water quality in the pit was estimated from modeling that included the following inputs and reactions: 1) the quality and quantity of groundwater inflow and outflow; 2) pyrite oxidation rates in exposed wall rock; 3) chemical releases from oxidized wall rock and waste rock; 4) aqueous geochemical reactions in the pit lakes; 5) evaporation from the pit lake surfaces; 6) direct precipitation into the pit lakes; 7) runoff from pit walls; and 8) exchange of carbon dioxide between the pit lakes and the atmosphere.

The following paragraphs provide a brief summary of the major inputs and assumptions used in the modeling. Additional details and supporting information are provided in the pit lake geochemistry modeling report for the proposed project (Schafer 2012a).

Pit lake water quality was modeled on the assumption that water compositions would be determined by the proportions of three types of water entering the pit:

- Precipitation;
- Runoff that flows across the weathered highwall; and
- Groundwater that flows through the submerged portion of the weathered highwall.

The compositions of both runoff and groundwater input would vary with time as different rock types are exposed/submerged in the pit walls. Groundwater inputs from different aquifers would vary as a result of water level changes. The three pits are very similar but, because their geometries and predicted wall rock compositions are not identical, each was modeled separately.

Precipitation. Average annual precipitation amounts were based on long-term records from the Elko Airport supplemented by monitoring at the BGMI facility over the past 18 years. A value of 10 inches per year was used in the modeling.

Pit Wall Geochemistry. The rocks exposed in the pit highwall play an important role in determining pit lake water quality. The amount of chemical load that may be rinsed from the highwall is closely related to the acid generation potential of the rock. The majority of the rock in the highwall is either oxidized or contains abundant carbonate minerals or both. Consequently, the average NNP of exposed highwall rock in the existing and proposed pit is 146 kg/t and 137 kg/t, respectively (**Table 3.4-8**). Overall, 1.8 percent of the existing pit walls and 5 percent of the proposed pit surface contains rock that would be considered PAG based on NNP values less than 0 kg/t (Schafer 2012a).

Runoff from Pit Walls. The pit walls would consist of four stratigraphic units, the Carlin Formation, the Vinini Formation, the Rodeo Creek Unit, and the Bootstrap Limestone described in Section 3.3.1.4, Site Geology and Mineralization. Runoff would result from both meteoric water input and groundwater discharge above the level of the contemporaneous pit lake. Runoff compositions from each lithology in the exposed wall rock were estimated from a series of experiments: rinsing experiments on fresh and weathered rocks, humidity cell tests, and meteoric water mobility tests (Schafer 2012a).

Groundwater Inflow. The inflow of groundwater from each aquifer to each pit over time was estimated using the calibrated regional hydrologic model described previously. Water is derived from three aquifers: the Carlin Aquifer, the Vinini Aquifer, and the carbonate aquifer. In the long-term, the carbonate aquifer would be the dominant source of water to all three pits.

Geochemical Modeling. After the inputs to the lakes had been calculated, the geochemical evolution of the resulting lake was calculated using the geochemical computer program PHREEQC (Parkhurst and Appelo 1999). PHREEQC can perform various calculations, including chemical equilibrium with selected solid phases, equilibration with an atmosphere, equilibration at operator-selected redox levels, and evaporation. The output from PHREEQC provides predictions of the chemical composition of water after chemical equilibration (and other specified reactions) has taken place.

During the early stages of pit filling, most of the water flowing into the pit lakes would come from highwall runoff with lesser amounts of groundwater from the Carlin and Vinini aquifers. Until groundwater levels reach the base of the pits, virtually all water that enters the pits would infiltrate out of the bottom of the pits into the carbonate aquifer.

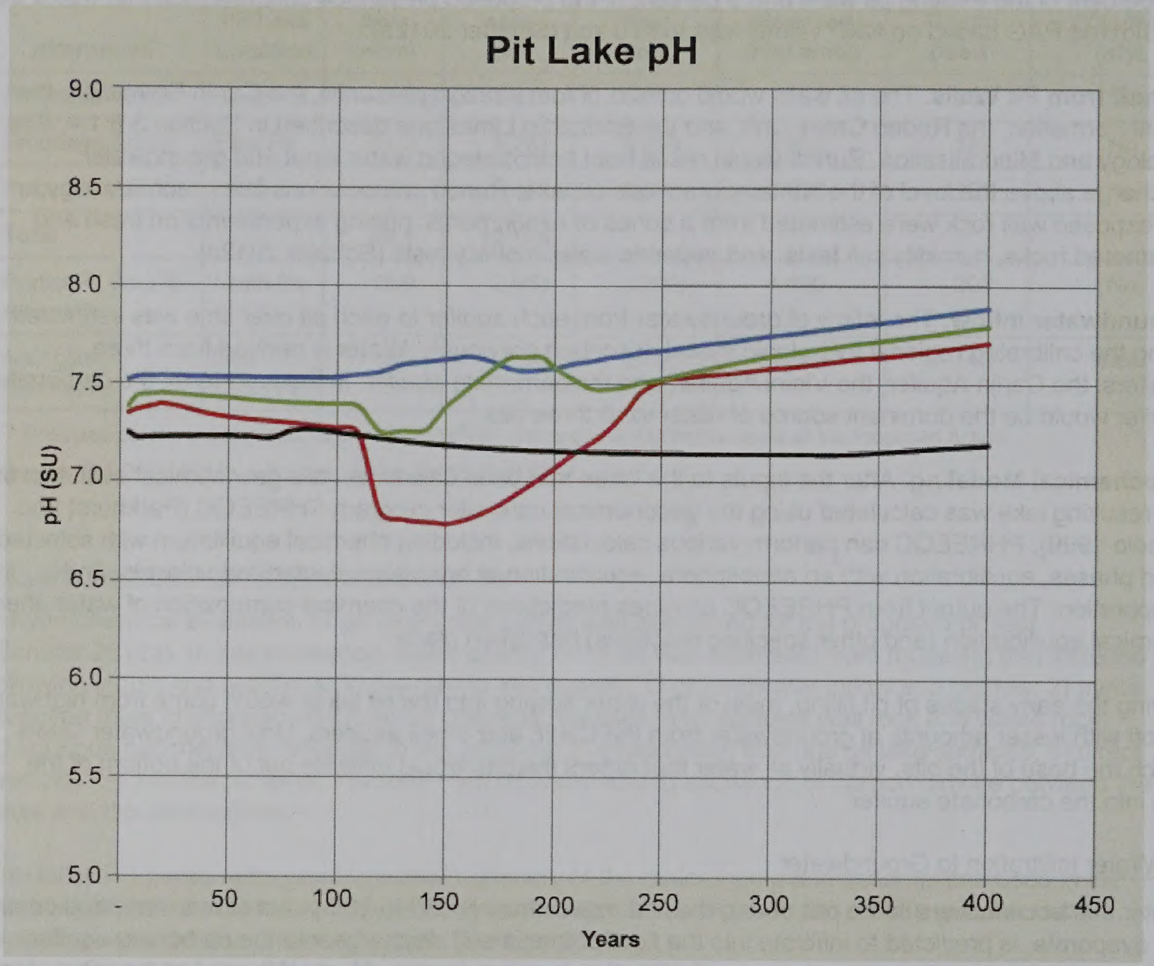
Pit Water Infiltration to Groundwater

Water that accumulates in the pits during the first approximately 150 to 200 years of recovery, and does not evaporate, is predicted to infiltrate into the floor of the pit and discharge into the carbonate aquifer system (JSA 2010b). The estimated rate of infiltration is approximately 75 afy (50 gpm) at the initial stage of recovery, increases to approximately 150 afy (90 gpm) by Year 100, and then gradually declines to zero when the permanent pit lakes form as a result of inflow from the carbonate aquifer after 200 years.

The composition of the infiltrating water was predicted by the same procedure based on PHREEQC as was used for the final pit lakes. The pit water captured in the South, East, and North Pit lakes would have an initial pH of approximately 7.3 to 7.5 and a TDS of 600 to 900 mg/l (**Figures 3.4-9** and **3.4-10**, respectively). The TDS is predicted to gradually decrease as the highwall is rinsed by meteoric water. A sharp increase in the TDS concentrations would occur when inflow from the carbonate aquifer begins.

This results from a renewed influx of soluble salts as weathered carbonate rock is rinsed by flow from the carbonate aquifer.

Nevada regulations address the post-mining pit lakes and provide that pit lakes must not have the potential to degrade groundwaters of the State or adversely affect the health of human, terrestrial, or avian life (NAC 445A.429[3]). The predicted water chemistry of the infiltrated pit water is summarized in **Table 3.4-11**. This predicted water quality also represents the quality of any shallow ponding that may occur in the pit prior to permanent pit lake development. Predicted concentrations of antimony, arsenic,



Legend
- South Pit
- North Pit
- East Pit
- Existing Pit

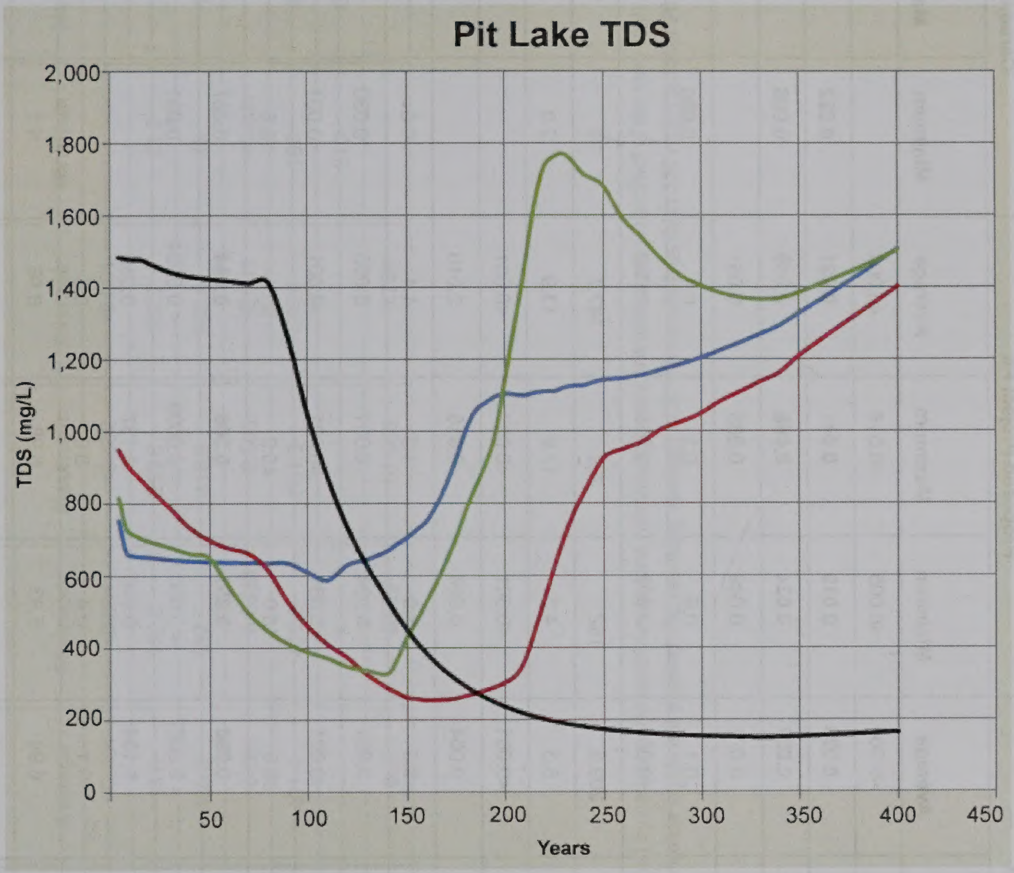
Source: Schafer 2012a.

05/21/2012

Dee Arturo Expansion Project

Figure 3.4-9

Predicted Trends in pH for the South, North, and East Pit Lakes (Proposed Action) and Existing Pit (No Action)



Legend

- South Pit
- North Pit
- East Pit
- Existing Pit

Source: Schafer 2012a.

05/16/12

Dee Arturo Expansion Project

Figure 3.4-10

Predicted Trends in TDS for the South, North, and East Pit Lakes (Proposed Action) and Existing Pit (No Action)

Table 3.4-11 Predicted Water Quality of Outflow from the Pits Prior to Permanent Development of Pit Lakes

Constituent (mg/l)[1]	Nevada Drinking Water Standards[2]	No Action Pit			Proposed Project Pit			Carbonate Aquifer[7]		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Aluminum	0.054[3] – 0.2[4]	<0.004	<0.005	<0.004	<0.005	<0.018	<0.004			
Antimony	0.006	**0.036**	**0.042**	**0.038**	**0.019**	**0.041**	**0.021**	**0.022**	**0.050**	**0.035**
Arsenic (total)	0.01	0.010	**0.097**	**0.029**	**0.024**	**0.088**	**0.059**	0.008	**0.451**	**0.021**
Barium	2.0	0.032	0.110	0.075	0.049	0.085	0.061			
Boron	--	0.0	0.5	0.1	0.0	0.2	0.1	0.600	0.847	0.767
Cadmium	0.005	<0.002	<0.006	<0.003	<0.002	<0.003	<0.002			
Calcium	--	128.2	397.2	209.8	152	229	182.7	39	109	88.9
Chloride	250[3], 400[4]	3.8	15.3	5.3	4.3	17.6	13.9	3.0	19	14.9
Chromium (total)	0.1	<0.001	<0.001	<0.001	<0.001	<0.007	<0.001			
Copper	1.3[5], 1.0[4]	0.001	0.012	0.004	0.008	0.018	0.010			
Fluoride	2.0[3], 4.0[4]	0.9	1.9	0.9	1.0	1.9	1.1	0.6	1.6	1.3
Iron	0.3[3], 0.6[4]	0.001	0.001	0.001	0.004	0.001	0.005	0.030	14.7	0.308
Lead	0.015[5]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.012	0.007
Magnesium	125[3], 150[4]	8.9	78.3	30.6	18.0	45.2	33.1	19.0	32.0	21.9
Manganese	0.05[3], 0.1[4]	0.034	**0.724**	**0.098**	**0.053**	**0.306**	**0.094**	0.007	**0.092**	0.013
Mercury	0.002	< 0.0007	< 0.0008	< 0.0007	< 0.0003	< 0.0006	< 0.0004	0.001	0.00222	0.0007
Nickel	0.1	0.069	**0.285**	**0.104**	0.046	**0.137**	0.065			
Nitrate (as N)	10	0.1	0.3	0.1	0.4	0.8	0.5			
pH (standard units)	6.5 – 8.5[4]	6.85	6.99	6.94	6.93	6.98	6.96	5.1	8	6.7
Potassium	--	5.3	16.1	6.5	6.5	10.4	7.3	6.6	25	20.9
Selenium	0.05	0.005	**0.207**	0.022	0.009	**0.084**	0.021	0.002	0.004	0.004

Table 3.4-11 Predicted Water Quality of Outflow from the Pits Prior to Permanent Development of Pit Lakes

Constituent (mg/l)[1]	Nevada Drinking Water Standards[2]	No Action Pit			Proposed Project Pit			Carbonate Aquifer[7]		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Silver	0.1[4]	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001			
Sodium	--	8.9	59.4	13.6	152.0	229.0	182.7	21.0	85.5	73.9
Sulfate	250[3], 500[4]	36.7	**897.9**	308.0	137.5	410.6	260.9	48	160	77.0
Thallium	0.002	0.000	0.014	0.001	0.0005	0.006	0.001	<0.001	<0.001	<0.001
Bicarbonate	--	407.9	488.9	461.4	457.0	501.0	475.9	195	582	414.5
TDS[6]	500[3], 1,000[4]							310	672	566.2
Zinc	5.0[4]	0.040	1.749	0.501	0.625	01.969	0.769			0.017

[1] Units are mg/l unless otherwise noted.

[2] Nevada primary MCLs unless otherwise noted.

[3] Federal secondary MCLs.

[4] Nevada secondary MCLs.

[5] Value is action level for treatment technique for lead and copper.

[6] For the No Action and Proposed Action pit lakes; the TDS is dominated by calcium and bicarbonate ions, whose high concentrations are an artifact of the very high partial pressure of carbon dioxide determined for the carbonate aquifer. If atmospheric carbon dioxide levels are applied, the resulting average TDS values are less than 500 mg/l (Schafer 2012a).

[7] Source for carbonate aquifer data: BLM 2008b, Table B-2.

Note: Bold values exceed Nevada Drinking Water Standards.

Source: Schafer 2012a.

nickel, and selenium in the infiltration water from one or more of the pit lake areas would exceed the primary Nevada water quality standards for drinking water. In addition, the predicted manganese, sulfate concentrations, and TDS from one or more of the pit lake areas would exceed the Nevada secondary drinking water standards. The minimum, maximum, and average concentrations in the carbonate aquifer also are listed for comparison in **Table 3.4-11**. The predicted average concentrations of these constituents over the infiltration period also would exceed the average background water quality for the carbonate aquifer in the region. However, the range of concentrations of antimony and arsenic predicted for the proposed pit are within the range of concentrations that naturally exist in the carbonate aquifer. The maximum predicted concentration of selenium (0.084 mg/l), and manganese (0.306) would be greater than the maximum concentrations reported for the carbonate aquifer.

The movement of infiltration from the open pit was evaluated using the regional groundwater flow model described previously. Specifically, particle tracking was used to identify the likely flow paths that would occur over time from the infiltrating water (JSA 2010d). The results indicate that flow infiltrating in the pit area at Year zero would travel south toward the Betze Pit. Later flow (released at 50, 100 years, and 150 years after the start of recovery) would travel toward the west.

Attenuation batch testing and numerical modeling were conducted to assess the potential fate and transport of key metals and TDS that may infiltrate through the pit floors into bedrock prior to development of permanent pit lakes controlled by recovery of the regional carbonate aquifer. The Bootstrap Formation would be exposed in the floor of the proposed pits and would be the receptor of flow that infiltrates from the pit prior to pit lake development. Minerals within the Bootstrap Formation may absorb or precipitate dissolved constituents within the solutions that infiltrate the pit floor. Samples of rock core taken from the Bootstrap Formation were selected to represent materials that would be exposed in the pit floor. These samples were then tested to evaluate their sorption capacity for the six metals of concern (arsenic, antimony, manganese, nickel, selenium and thallium). Although some of the isotherms are not well constrained, the experiments do show strong adsorption of the elements of interest, which indicates that migration would be limited. Overall, the results of the batch testing indicate that the Bootstrap Formation has the capacity to absorb and precipitate constituents of concern and inhibit migration (Geomega 2011; Schafer 2012b, 2011b)

Solute transport modeling was conducted to simulate sorption along potential flow paths between the pit bottom and the groundwater aquifer. For simplicity, water infiltrating the pit flow was assumed to connect with the deeper aquifer system with no retention time or attenuation in the vadoze zone. The analysis was conservative since it did not account for dilution or dispersion that would occur as the pit infiltrate entered the groundwater flow system. Separate model simulations were conducted for each constituent of concern. The results of the modeling indicate that the elevated metals concentrations would not be detected further than 20 to 50 meters (70 to 170 feet) from the margin of the pit. TDS of water infiltrating from the pits would be less than 500 mg/l, but would increase in the deeper aquifer due to calcite dissolution. If the deep groundwater were pumped to the surface for use, its TDS would again drop below 500 mg/l under atmospheric conditions due to off-gassing and calcite precipitation. (Schafer 2011b). Because elevated metals concentrations are not expected to affect groundwater quality outside the footprint of the pits, infiltration from the pits is not likely to adversely affect the carbonate aquifer.

Pit Water Quality Predictions

As described previously, permanent pit lakes are predicted to develop in the South, East, and North Pits at 100, 150, and 170 years, respectively, when inflow from the carbonate aquifer enters the pit areas. The pH predictions shown in **Figure 3.4-9** indicate that the lakes would be near neutral (pH 6.8 to 8). This new source of inflow (i.e., the carbonate aquifer) would result in the rinsing of soluble salts in the weathered carbonate and would result in a sharp increase in TDS (**Figure 3.4-10**). Once permanent pit lakes form, groundwater outflow would cease and evapoconcentration would result in a gradual increase in TDS, reaching TDS levels of 1,400 to 1,500 mg/l at the end of the simulation period. In the longer term (beyond 400 years), the salinity of the pit lakes steadily would increase in response to evaporation. Groundwater would continue to flow into the pits to replace water lost by evaporation, and the solutes in the water (other than those lost by precipitation of carbonate) would accumulate.

Water in the South, North, and East pit lakes would be calcium-sulfate type water initially and would transition to calcium-bicarbonate water as highwall rinsing progresses and then sodium-bicarbonate water after approximately 300 years due to evaporation and precipitation of calcium carbonate.

The behavior of several trace elements, and hydrous ferric oxide, is sensitive to redox conditions in the water. It was assumed in the modeling that the pit lake waters would remain oxidizing. A review of pit lakes that are analogous to the pit lakes that would develop under the Proposed Action (Schafer 2012a) indicates that the pit lakes are likely to turn over seasonally: once or more each year. It is, therefore, realistic to assume that the waters would remain oxidizing at all depths.

The long-term (400-year) predicted pit lake water chemistry for the Proposed Action is summarized in **Table 3.4-12**. Although the pit lakes are not intended to be used as a drinking water source for human consumption, **Table 3.4-12** includes the current Nevada Drinking Water Standards as a reference. The pit lake water has predicted constituent concentrations that exceeded the Nevada primary water quality standards for antimony and arsenic. The predicted concentrations of fluoride, manganese, sulfate, and TDS also exceed the Nevada secondary drinking water standards. These pit lakes are predicted to eventually behave as groundwater sinks. As a result, it is anticipated that in the long term (after approximately 200 years), these lakes would not affect the water quality of downgradient aquifers. The potential risk to wildlife associated with exposure to the pit lakes is addressed in Section 3.17, Wildlife and Aquatic Biological Resources.

Waste Rock Disposal Facilities

The geochemical testing data for waste rock material is summarized in Section 3.4.1.4, Rock Geochemistry. Exploration drilling data and geochemical testing results were entered into a geologic block model to estimate the waste materials and mass of PAG waste rock generated during mining (**Table 3.4-13**). The modeling indicates that approximately 3.5 percent of the total waste rock tonnage may be acid generating. A large fraction of the waste rock tonnage (46 percent) would be from the Carlin Formation, the oxidized Bootstrap, and oxidized Rodeo Creek material, which are non acid-generating. The next largest group of waste rock material (39 percent) is Vinini Formation, which has a small percentage (3.9 percent) of material that may generate acid. The Rodeo Creek sulfide material comprises approximately 8.5 percent of the total waste rock material, and approximately 23 percent of the Rodeo Creek sulfide bearing material is potentially acid-generating.

The metals leaching risk of rocks is closely related to the solution pH. Samples that generated acidic conditions (<5.5) in MWMP tests or humidity cell tests had moderate to high levels of base metals while near-neutral samples had mostly low base metal levels. Some rock samples contained elevated levels of arsenic and antimony, but rarely mercury. Although soluble levels of oxyanions are often elevated at alkaline pH levels, the majority of these elements are retained in solid phase. In materials containing oxidized iron, an important mechanism that reduces the mobility of these metals is sorption on iron oxyhydroxides. Consequently, although small pockets of mineralized rock within the WRDFs may generate higher levels of soluble metals, arsenic and antimony would tend to become sorbed by adjacent rock masses as interstitial water from these zones migrates (Schafer 2009).

Table 3.4-12 Model-predicted Pit Lake Water Chemistry at Year 400

Constituent (mg/l)[1]	Nevada Drinking Water Standards[2]	No Action Pit Lake	Proposed Action Pit Lakes			Partial Backfill (North Pit Lake)
			South	North	East	
Aluminum	$0.05^3 – 0.2^4$	0.004	0.009	0.007	0.006	0.007
Antimony	0.006	**0.041**	**0.099**	**0.14**	**0.104**	**0.085**
Arsenic (total)	0.01	**0.037**	0.009	0.0005	0.003	**0.011**
Barium	2.0	0.110	0.042	0.038	0.038	0.039
Boron	--	0.03	1.7	1.8	1.7	
Cadmium	0.005	0.003	0.001	0.001	0.001	0.001
Calcium	--	18	30	68	48	82
Chloride	250^3, 400^4	4	79	50	68	38
Chromium (total)	0.1	<0.001	<0.001	<0.001	<0.001	0.0014
Copper	1.3^5, 1.0^4	0.001	0.031	0.021	0.026	0.020
Fluoride	2.0^3, 4.0^4	1.0	**4.3**	**5.0**	**4.5**	3.7
Iron	0.3^3, 0.6^4	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
Lead	0.015^5	<0.0001	0.0004	<0.0001	<0.0001	0.0002
Magnesium	125^3, 150^4	10	117	106	116	92
Manganese	0.05^3, 0.1^4	0.04	**0.20**	**0.30**	**0.28**	**0.25**
Mercury	0.002	< 0.001	< 0.003	< 0.004	< 0.003	0.002
Nickel	0.1	0.07	0.13	0.25	0.20	0.23
Nitrate (as N)	10	0.1	2.3	1.5	2.3	1.4
pH (standard units)	$6.5 – 8.5^4$	7.20	7.89	7.71	7.80	7.67
Potassium	--	6	62	69	63	50
Selenium	0.05	0.006	0.023	0.036	0.032	0.032
Silver	0.1^4	<0.001	<0.005	<0.0016	<0.005	0.004
Sodium	--	10	245	211	230	156
Sulfate	250^3, 500^4	39	**548**	**603**	**624**	**562**
Thallium	0.002	0.0003	<0.002	<0.002	<0.002	0.002
Bicarbonate	--	69	347	235	282	210
TDS	500^3, 1000^4	157	1428	1343	1432	1190
Zinc	5.0^4	0.04	0.19	0.43	0.29	0.768

[1] Units are mg/l unless otherwise noted.

[2] Nevada primary MCLs unless otherwise noted.

[3] Federal secondary MCLs.

[4] Nevada secondary MCLs.

[5] Value is action level for treatment technique for lead and copper.

Note: Bold values exceed Nevada drinking water standards.

Source: Schafer 2012a, 2011c.

Table 3.4-13 Estimated Waste Rock Generated by Proposed Action Mining

Waste Material Type	Estimated Tons	Percent of Total Waste Rock	Estimated Tons of PAG	Percent PAG
Fill	33,300,000	5.5	0	0
Carlin	228,200,000	38.0	0	0
Vinini	235,800,000	39.3	9,196,200	3.9
Rodeo Creek Oxide	40,400,000	6.7	0	0
Rodeo Creek Sulfide	50,900,000	8.5	11,910,600	23.4
Bootstrap Oxide	6,505,000	1.1	0	0
Bootstrap Sulfide	5,207,000	0.9	0	0
Total Waste	**600,312,000**	**100.0**	**21,106,800**	**3.5**

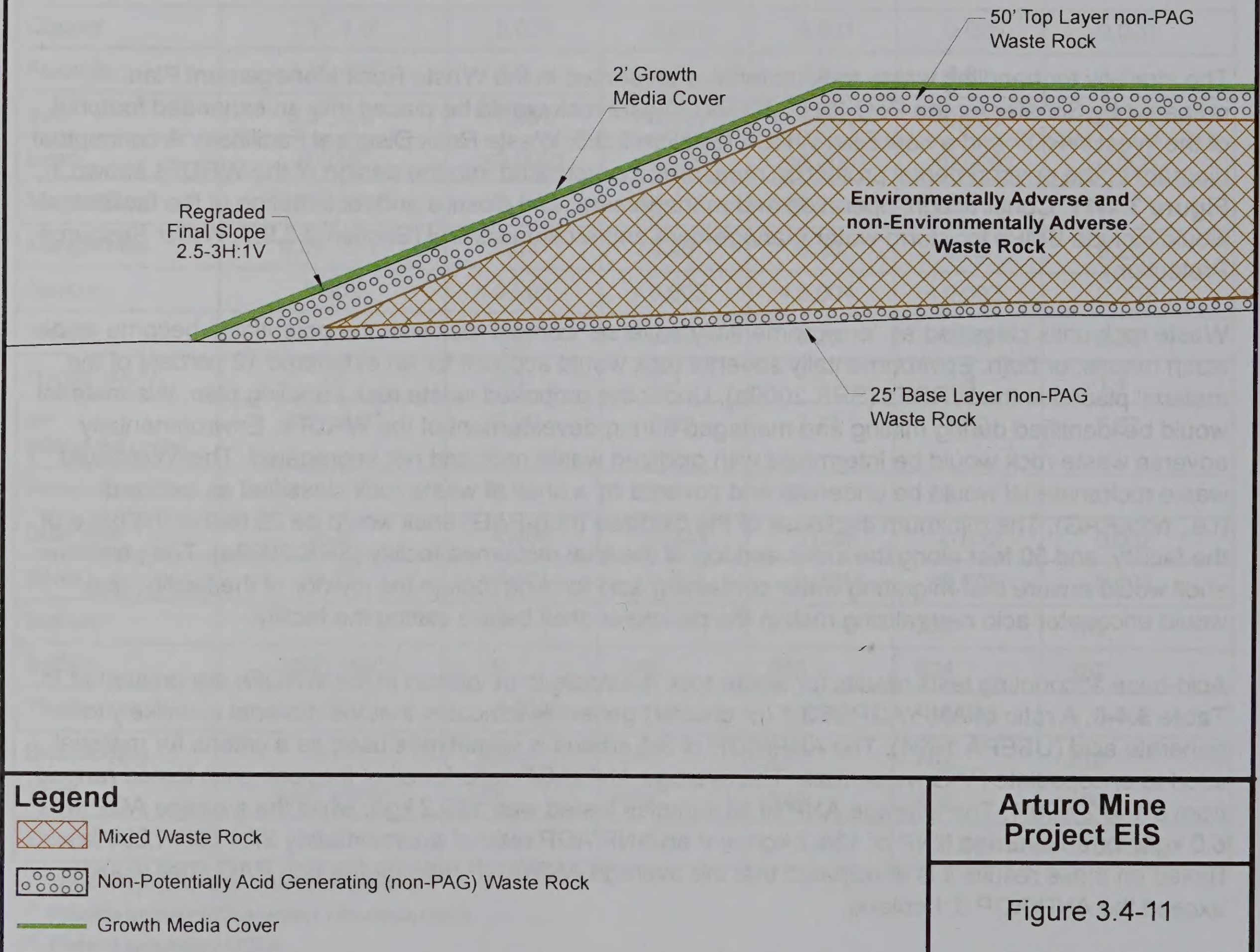
Source: Schafer 2011b.

The strategy for handling waste rock material is presented in the Waste Rock Management Plan prepared by Schafer for the PoO (SRK 2009a). Waste rock would be placed into an expanded footprint of the West WRDF and a new East WRDF (Section 2.3.3, Waste Rock Disposal Facilities). A conceptual diagram of the environmental protection measures incorporated into the design of the WRDFs shown in **Figure 3.4-11**. Construction, operation and management, and closure and reclamation of the facilities would include BMPs for storm water management and erosion control (Section 2.3.9.7, Water Resource Protection).

Waste rock units classified as "environmentally adverse" contain rock with the potential to become acidic, leach metals, or both. Environmentally adverse rock would account for an estimated 12 percent of the material placed in the WRDFs (SRK 2009a). Under the proposed waste rock handling plan, this material would be identified during mining and managed during development of the WRDFs. Environmentally adverse waste rock would be intermixed with oxidized waste rock and not segregated. This intermixed waste rock material would be underlain and covered by a shell of waste rock classified as oxidized (i.e., non-PAG). The minimum thickness of the oxidized (non-PAG) shell would be 25 feet at the base of the facility, and 50 feet along the sides and top of the final reclaimed facility (SRK 2009a). The perimeter shell would ensure that migrating water contacting acid forming rock in the interior of the facility also would encounter acid neutralizing rock in the perimeter shell before exiting the facility.

Acid-base accounting tests results for waste rock materials to be placed in the WRDFs are presented in **Table 3.4-6**. A ratio of ANP/AGP of 3:1 (or greater) generally indicates that the material is unlikely to generate acid (USEPA 1994). The ANP/AGP of 3:1 criteria is sometimes used as a criteria for material used to encapsulate PAG waste rock. The average ANP/AGP ratio for all of the rock units tested ranged from 5:1 to 2,900:1. The average ANP of all samples tested was 160.2 kg/t, while the average AGP was 6.0 kg/t, for an average NNP of 154.2 kg/t and an ANP/AGP ratio of approximately 27:1 (SRK 2009a). Based on these results it is anticipated that the average ANP/AGP ratio for the non PAG shell would exceed the ANP/AGP 3:1 criteria.

The WRDFs are sited and designed to minimize the risk of impact to waters of the State. During operations, little if any flux of meteoric water is expected to occur within the WRDFs because of the dry nature of rock when it is initially placed and the dry climate at the site. Reclaimed landforms would promote long-term geomorphic stability. Additionally, closure practices have been recently implemented at the BGMI facility that reduce or eliminate infiltration of water and oxygen (Zhan et al. 2006); these closure practices would be applied to the proposed project. This design, involves shaping the facility to a



Arturo Mine Project EIS

Figure 3.4-11

WRDF Schematic Cross-section Showing Encapsulation of Environmentally Adverse Waste Rock

Source: BDMV 2012.

05/16/12

geomorphically stable configuration, placing a soil cover composed of Carlin and/or topsoil material that incorporates high water holding capacity and includes capillary breaks to reduce net infiltration, and establishment of perennial vegetation to meet post-mining land use objectives.

Relationship to Adjacent Surface Water and Groundwater

The existing WRDF is within the headwaters of a small ephemeral tributary to upper Boulder Creek. The WRDF was constructed with a French drain to conduct any flows that occurred in the facility foundation. Small flows from the French drain are collected in a small pond (the BLM detention pond at AR36 and AR09 in **Figure 3.4-2**) that would not be covered by the waste rock material. Water quality data for this feature is reported in **Table 3.4-5** for Sites AR09 and AR36. During operations, storm water from the proposed WRDFs would be managed under a general permit issued by NDEP. Sediment releases would be minimized or eliminated using a variety of best management practices (Section 2.3.6.9, Storm Water Management Facilities).

After mining cessation, the WRDFs would be covered with growth media. After reclaimed vegetation becomes established and drainage systems stabilize, any surface runoff (expected to be an infrequent occurrence based on climatic conditions, predictive modeling, and observation) is expected to be suitable for release to waters of the State without storm water controls. The vegetated slopes and channel network would minimize sediment movement.

Groundwater is located in carbonate rock, at a depth of more than 1,000 feet beneath the WRDF. Groundwater also occurs as discontinuous or localized perched systems in the Carlin Formation deposits and Paleozoic clastic units.

Water Movement During Mine Operations

While the net infiltration of water through a cover dictates the amount of meteoric water that may contact waste rock in the long term, the water content of waste rock also is an important short-term factor affecting potential water movement within the dump. Rock material contains little water when mined because it has an inherently low porosity and has been desaturated by mine dewatering. When rock is blasted, mined, hauled, and placed, its void space and porosity increases from a few percent to 30 percent or more. Rock initially placed in the WRDFs would have approximately 2 to 3 percent volumetric water content. The equilibrium water content of waste rock (the field capacity) is expected to range from 5 to 8 percent volumetric water content in coarse rock (SRK 2009a). Therefore, rock material would need to absorb from 2 to 6 percent water before appreciable water movement would occur. Consequently, during and immediately after operations, the waste rock would absorb any percolation of meteoric water until the field capacity is reached and noticeable drainage occurs. Toe seepage may be observed during the operational phase due to the potential preferential flow, snowmelt infiltration, and surface water runoff from the sloped area.

Water Movement in the Post-closure Period

The reclamation plan proposed for the West and East WRDFs specifies the amount and type of plant growth media to be placed over the graded facility, the slope angles to be achieved, and the seed mix to be used. Evaporation and transpiration by vegetation extracts water from near-surface layers, predominantly during warmer periods, leaving a moisture-depleted plant root zone by fall, which can store water. Available information indicates that a vegetated evapotranspiration cover (consisting of topsoil or Carlin material) can reduce infiltration of meteoric water to pre-mining levels that occur naturally (SRK 2009a).

The proposed operational waste rock management plan and cover design are critical elements in achieving satisfactory long-term environmental performance. The net alkaline character of waste rock, the relatively small volume of acid-generating material, and the selective handling program would further help protect waters of the State. The waste rock classification, segregation, and selective placement program are designed to reduce the occurrence of acid rock drainage and migration of soluble metals, and to prevent releases of surface runoff, seepage, or infiltration that degrade waters of the State. The reclamation and closure approach for the facility is to grade and cover waste rock to prevent contact between waste rock and surface runoff, to minimize or eliminate seepage and infiltration of water, and to reduce the diffusive flux of oxygen into the facility after closure of the facility. Minimization of net infiltration into the WRDFs through use of soil covers would provide an effective means of preventing migration of interstitial water from the facility, thereby protecting surface water and groundwater quality.

Heap Leach and Other Process Facilities

Impacts to surface water quality from the heap leach and other process-related facilities would occur: 1) if process fluids, fuels, solvents, or other liquids were released to surface waters in sufficient quantities to exceed water quality standards or degrade beneficial uses; and 2) if runoff, erosion, or sedimentation were accelerated to a degree that degraded surface water flows or features.

Since the proposed project would be designed and operated as a zero-discharge facility in accordance with NDEP mining regulations, impacts from process fluids would be unlikely under anticipated construction and operating conditions. The heap leach and ancillary facilities would be constructed with geomembrane liners, lined ditches, and monitored leak detection/collection systems in compliance with NDEP design requirements. Plant facilities, storm water diversions, and solution and storm water event ponds also would be designed in accordance with regulations and interagency agreements. Compliance with interagency closure and reclamation requirements, including monitoring, would minimize the potential for long-term effects on surface water quality after cessation of proposed project operations. Based on these project commitments, no impacts to surface water quality are anticipated from process components under anticipated construction and operating conditions. Ore processing at the BGMI facility would be conducted under currently permitted authorizations. As a result no additional impacts to surface water quality are anticipated from ore processing at the existing BGMI process facilities.

Storm Water Management

Storm water would be managed under the proposed project in accordance with the Nevada General Storm Water Permit NVR300000 and the site Storm Water Pollution Prevention Plan (SWPPP). BMPs would be applied to route or control runoff and would reduce potential impacts from accelerated erosion and sedimentation. Storm water BMPs are discussed in Chapter 2.0, Section 2.3.6.9, Storm Water Management Facilities. Accepted engineering practices would be used to design and apply storm water controls such as diversion ditches, sediment traps, rock and gravel covers, or other applications. Concurrent reclamation and long-term reclamation practices (Chapter 2.0) would help reduce erosion and sedimentation from proposed project components.

Although potential impacts would be avoided or reduced under anticipated construction and operating conditions by compliance with agency programs and proposed measures, extreme weather events may create bypass conditions or unforeseen impacts. Severe (high intensity) storms, rapid snowmelt, or rain-on-snow events have the potential to damage operating or reclaimed project components. This has been known to occur at other mining sites in the region (BLM 2008b). Resulting adverse effects may include degradation of waters of the State and delays in successful restoration of post-mining land uses.

Both WRDFs have comparatively small upgradient catchment areas. This would reduce the need for designed diversion structures along their upgradient perimeters. Similar conditions would exist at the proposed pit. Small storm water control basins would be constructed upgradient of these components. Approximately 80 acres would drain to the basin near the proposed pit in Section 34. Approximately 160 acres would drain to the easternmost constructed storm water basin at the West WRDF in Section 27, and approximately 40 acres would drain to the constructed basin in the southeast corner of Section 28. Given the upgradient locations, proposed waste rock management plan (SRK 2009a), and proposed evapotranspiration cover on the WRDFs, acid rock drainage accumulation is not likely to occur at these locations. Meteoric water and run-on would seasonally accumulate in the storm water basins.

Evaporation of that water may elevate the concentrations of TDS and other constituents, notably arsenic, which was identified in MWMP test results described previously in Section 3.4.1.4, Rock Geochemistry, and in Appendix A of the PoO. While such water would be isolated within the small, immediate watersheds, adverse water quality conditions may occur on a seasonal basis.

Haul Road Improvements

As stated in the SWPPP, road surfaces would be sloped gently toward ditches running the length of the roads. These ditches would have stabilized cut-outs or culverts and energy dissipation features to distribute storm water flows and reduce flow velocities. Storm water routed from roads would ultimately lead to sediment basins (as needed), open pits, or natural drainages.

As described in Chapter 2.0, Section 2.3.5.2, Bootstrap Haul Road, the Bootstrap Haul Road currently crosses Boulder Creek and Bell Creek via an earth-fill roadway that incorporates a series of culverts. Under the Proposed Action, the culverts would be extended to accommodate additional road width. Accelerated erosion, sedimentation, and runoff water quality would be controlled by storm water BMPs used along the road as discussed in Chapter 2, Section 2.3.6.9, Storm Water Management Facilities, and in Appendix D of the Plan of Operations ("Stormwater Pollution Prevention Plan and Stormwater Monitoring Plan").

Water or approved dust suppressants such as magnesium chloride, calcium chloride, or lignin-sulfate would be used to minimize fugitive dust on the road. Dust suppressants would be sprayed in a manner that only moistens the road surface and minimizes run-off into adjacent areas. Dust suppressants would only be applied within the bermed road area. Similar to the existing road drainage features, the widened Bootstrap Haul Road would employ culvert crossings and berms, ditches and ditch outlets, relief culverts, armoring and energy dissipation, and other erosion control practices to control runoff and sedimentation from the road surface.

On the basis of these provisions, incremental water quality impacts to Boulder or Bell creeks are not anticipated to be noticeable from the Bootstrap Haul Road modification and maintenance.

3.4.2.2 Single Waste Rock Disposal Facility Alternative

Under the Single WRDF Alternative, the East WRDF would not be constructed. The Single WRDF alternative would eliminate direct impacts to a small ephemeral watershed area of approximately 197 acres that is tributary to Boulder Creek that would be located within the footprint of the East WRDF under the Proposed Action. As a result, any potential for seepage, or runoff, erosion and sedimentation impacts to Boulder Creek associated with the East WRDF would be avoided under this alternative.

Changes in contributing watershed areas under the Single WRDF Alternative would be similar to those described for the Proposed Action. The watershed area affected by the Single WRDF would represent approximately 0.3 percent of the Antelope Creek drainage and about 0.1 percent of the Rock Creek Valley (Hydrographic Basin 62). The absence of the East WRDF would allow runoff contributions from approximately 54 additional acres in the upper Boulder Creek watershed in comparison to the Proposed Action. Under existing conditions, approximately 513 acres of disturbance do not drain to the watershed. Under the Single WRDF Alternative, surface runoff from approximately 1,572 acres within the project area would be restricted from draining to upper Boulder Creek. These ephemeral headwater areas would comprise approximately 3.3 percent of the hydrologic study area, and approximately 0.44 percent of the Boulder Flat hydrographic basin.

Potential impacts to floodplains and flood hydrology from the Single WRDF Alternative would be minimal and similar to the Proposed Action. No federally delineated flood hazard zones have been identified within the proposed project area, and drainageways consist of narrow ephemeral streams.

The strategy for handling waste rock material is presented in the waste rock management plan submitted to BLM with the proposed PoO (SRK 2009a). A conceptual diagram of the environmental protection measures incorporated into the design of the West WRDF is shown in **Figure 3.4-11**. Since the geochemical characterization of the waste rock material, environmental protection measures incorporated into the design of the West WRDF, and closure and reclamation practices would be the same as the Proposed Action, the potential impacts to surface and groundwater would be similar to those previously described under the Proposed Action.

Storm water drainage ditches and small catchments would be constructed to manage runoff according to NDEP and BLM requirements. Meteoric water and run-on seasonally would accumulate in the storm water basins. Evaporation of that water may elevate the concentrations of TDS and other constituents, as discussed under the Proposed Action. Potential impacts associated with storm water basins would be similar to those under the Proposed Action for the West WRDF; potential impacts from the storm water basins on the East WRDF would be eliminated.

Impacts to springs, seeps, and ponds under this alternative would be the same as those described for the Proposed Action. All other project components in the Single WRDF Alternative are the same as those in the Proposed Action (including the open pit, heap leach facility, haul roads, process ponds, and ancillary facilities). Therefore, potential impacts to watershed areas and to streams, springs, and seeps and water rights associated with these project components would be the same as described under the Proposed Action.

3.4.2.3 Partial Pit Backfill Alternative

Under this alternative, impacts to surface water quantity and quality would be similar to those described for the Proposed Action. No perennial stream reaches would be disturbed, since none are located within the project area. Short reaches of unnamed ephemeral stream channels would be removed by project components. Similar to the Proposed Action, no springs would be removed, but seeps and/or wetlands would be removed as disturbance increases. Compliance with interagency requirements, including monitoring, would minimize the potential for long-term effects on surface water quality. Potential impacts from access roads and Heap Leach Pad No. 12 would be the same as those described for the Proposed Action.

Under the Partial Pit Backfill Alternative, the length of slopes on the West WRDF would be reduced and the area of the flatter crest surface would expand in comparison to the Proposed Action and the Single WRDF Alternative (see **Figure 2-18**). This would further reduce the potential for runoff and sedimentation from sideslopes at the West WRDF, but substantial surface water impacts from these source areas are not anticipated in general. Surface infiltration into the West WRDF would increase in comparison to the Proposed Action and the Single WRDF Alternative. The operational waste rock management plan would be the same as that implemented under the Proposed Action, however. Selective handling of waste rock, and the development of a vegetated soil cover over the waste rock, would still provide effective controls on the migration of interstitial water from the facility. This approach would avoid or reduce the potential impacts to waters of the state.

Under this alternative, the volume of East WRDF would be expanded in comparison to the Proposed Action, with corresponding substantial increases in slope lengths along the aspects draining to Boulder Creek. Under the Partial Pit Backfill Alternative, the expanded east-facing slopes would generally range from 1,500 to 2,000 feet long (see **Figure 2-18**). Although geomorphic drainage designs and storm water controls would be implemented, the potential for erosion, sedimentation, and related run off impacts to upper Boulder Creek would increase under the Partial Pit Backfill Alternative in comparison to the Proposed Action.

Changes in contributing watershed areas under the Partial Pit Backfill Alternative would be similar to those described for the Proposed Action. The watershed area affected by the West WRDF would represent approximately 0.3 percent of the Antelope Creek drainage and about 0.1 percent of the Rock Creek Valley (Hydrographic Basin 62). On the east side of the project area, the backfill configuration and the East WRDF would allow runoff contributions from approximately 145 additional acres in the upper Boulder Creek watershed when compared to the Proposed Action. Under existing conditions, approximately 513 acres of disturbance do not drain to the watershed. Under the Partial Pit Backfill Alternative, surface runoff from approximately 1,481 acres within the project area would be restricted from draining to upper Boulder Creek. These ephemeral headwater areas would comprise approximately 3.1 percent of the hydrologic study area, and approximately 0.41 percent of the Boulder Flat hydrographic basin.

Pit Lake Development

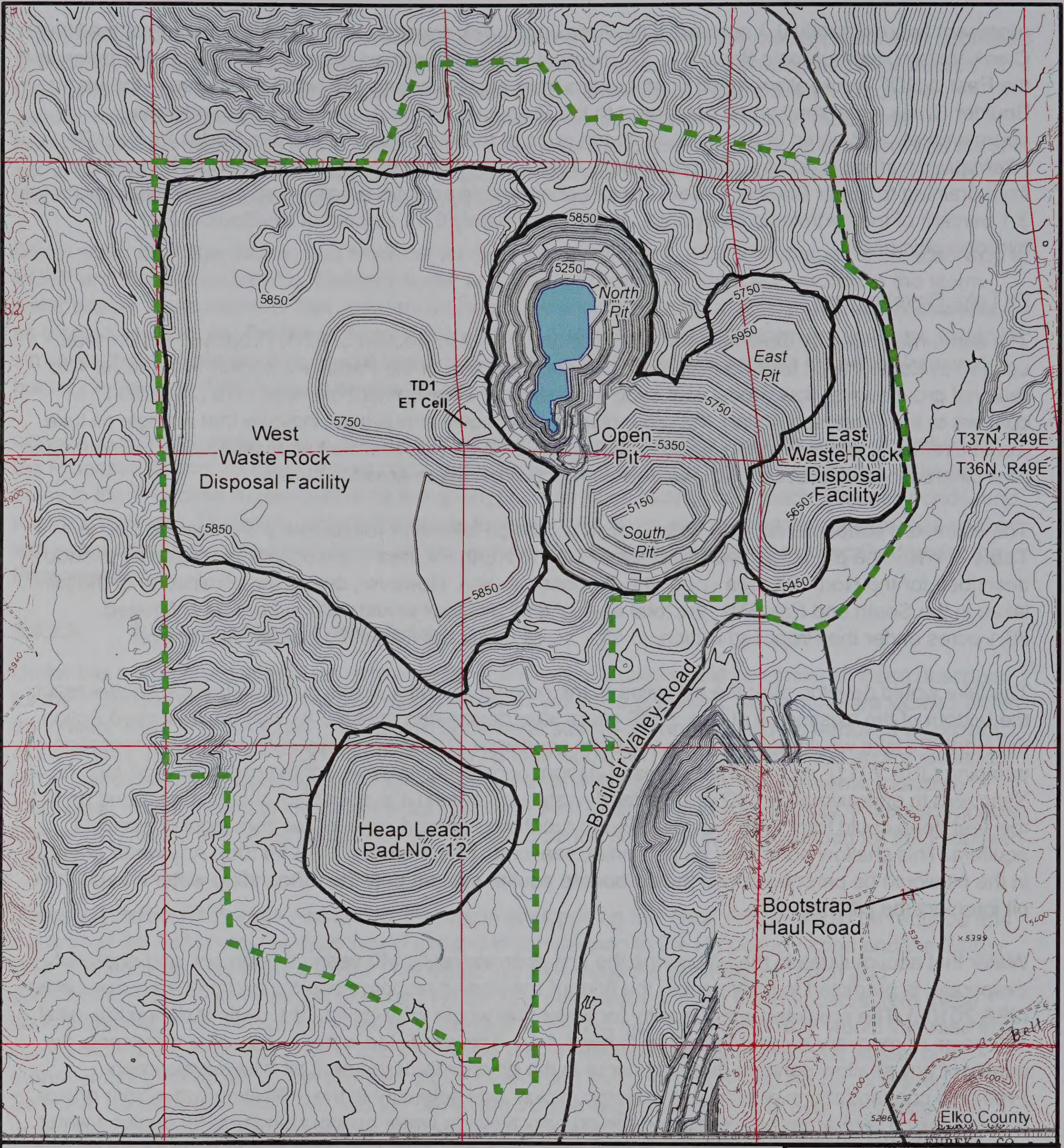
The same methodology described for the proposed project in Section 3.4.2.1, Proposed Action, was used to evaluate the pit lake development and geochemistry of the Partial Pit Backfill Alternative. The regional groundwater flow model was used to predict the development of the pit lake (JSA 2011). In contrast to the Proposed Action, the groundwater flow model simulations indicate that a single pit lake would eventually develop in the North Pit (**Figure 3.4-12**). The placement of backfill within the south and east pit areas would preclude pit lake development within these areas.

The estimated surface area, volume and depth of the pit lake after full recovery are summarized in **Table 3.4-10**. The predicted lake development in the North Pit area is essentially the same as previously described for the North Pit area under the Proposed Action. However, due to the elimination of the pit lakes in the South and East Pits, the total area of final pit lakes would reduce from an estimated 89.1 acres under the Proposed Action, to 19.1 acres under the Partial Pit Backfill Alternative.

The lake would develop after the elevation of the recovering water levels in the carbonate aquifer reach the bottom of the existing pit at about 140 years after dewatering ceases. As with the Proposed Action, the North Pit lake would approach steady state conditions at approximately 400 years after cessation of pumping (JSA 2011). As with the Proposed Action, prior to development of the permanent pit lake (from Year zero to approximately 140 years after dewatering ceases) it is possible that a shallow pond up to a few feet deep could form from the collection of runoff and groundwater inflow from local or perched aquifers. This shallow pond may be perennial, seasonal, or ephemeral (JSA 2010c). Any water ponded in the pit would be perched above the carbonate aquifer system until the rebounding water levels in the pit intersect the pit shell.

Water that accumulates in the pits during the first approximately 140 years of recovery, and does not evaporate, is predicted to infiltrate into the floor of the pit and recharge into the carbonate aquifer system (JSA 2010c). The predicted water quality for water that would infiltrate into the pit floor during the initial 140 years of recovery is summarized in **Table 3.4-14**. This predicted water quality also represents the quality of any shallow ponding that may occur in the pit prior to permanent pit lake development. Predicted concentrations of antimony, arsenic, nickel, and selenium in the infiltration water from one or more of the pit lake areas would exceed the primary Nevada water quality standards for drinking water. In addition, the predicted manganese, sulfate concentrations, and TDS from one or more of the pit lake areas would exceed the Nevada secondary drinking water standards. Overall, the predicted water quality for the North Pit is similar to the predicted water quality for the North Pit predicted under the Proposed Action. Therefore, potential effects to groundwater associated with this infiltration would be similar to those for the Proposed Action. However, the overall quantity of groundwater recharge from the pits during this period would be less than the Proposed Action.

Solute transport modeling results indicate that the elevated metals concentrations would not be detected outside the footprint of the pit (Schafer 2011c,d). TDS of water infiltrating from the pits would be less than 500 mg/l, but would increase in the deeper aquifer due to calcite dissolution. If the deep groundwater were pumped to the surface for use, its TDS would again drop below 500 mg/l under atmospheric conditions due to off-gassing and calcite precipitation (Schafer 2012b, 2011b). Because elevated metals



Legend

🟩 Proposed PoO Boundary

☐ Proposed Facilities

🟦 Predicted Pit Lake Surface 400 Years After BGMI Dewatering Ceases (approximately 5,093 feet amsl)

Note: 20-foot contour interval.
Contours do not reflect WRDF setback distance from open pit or reclamation topography design software.
Source: Schafer 2012a.

N

0 0.25 0.5 Miles

Arturo Mine Project EIS

Figure 3.4-12

Post-mining Pit Lake Partial Pit Backfill Alternative

8/21/2012

Table 3.4-14 Predicted Water Quality of Outflow from the Pit Prior to Permanent Development of a Permanent Pit Lake: Partial Pit Backfill Alternative

Constituent (mg/l)^1	Applicable Nevada Drinking Water Standards^2	Partial Backfill Alternative		
		Minimum	Maximum	Average
Aluminum	0.05^3 – 0.2^4	<0.004	<0.008	<0.006
Antimony	0.006	**0.021**	**0.039**	**0.028**
Arsenic (total)	0.01	**0.034**	**0.113**	**0.070**
Barium	2.0	0.041	0.084	0.06
Boron	--	0.1	0.3	0.3
Cadmium	0.005	<0.002	<0.004	<0.003
Calcium	--	155.3	277.8	198.4
Chloride	250^3; 400^4	3.2	14.7	7.4
Chromium (total)	0.1	<0.0002	<0.0002	<0.0002
Copper	1.3^5; 1.0^4	0.008	0.012	0.01
Fluoride	2.0^3; 4.0^4	1.0	1.7	1.2
Iron	0.3^3; 0.6^4	0.000	0.001	0.001
Lead	0.015^5	<0.001	<0.001	<0.001
Magnesium	125^3; 150^4	17.1	53.4	30.2
Manganese	0.05^3; 0.1^4	0.057	**0.419**	**0.135**
Mercury	0.002	< 0.0003	< 0.0005	< 0.0004
Nickel	0.1	0.055	**0.175**	0.099
Nitrate (as N)	10	0.1	0.5	0.3
pH (standard units)	6.5 – 8.5^4	6.90	6.97	6.94
Potassium	--	5.7	11.6	7.2
Selenium	0.05	0.011	**0.118**	0.033
Silver	0.1^4	<0.001	<0.002	<0.001
Sodium	--	8.5	43.6	18.3
Sulfate	250^3; 500^4	139.0	**539.2**	277.3
Thallium	0.002	0.000	0.008	0.002
Bicarbonate	--	446	488.7	470.7
TDS	500^3; 1,000^4	780	**1,437**	**1,015**
Zinc	5.0^4	0.79	1.95	1.25

[1] Units are mg/l unless otherwise noted.

[2] Nevada primary MCLs unless otherwise noted.

[3] Federal secondary MCLs.

[4] Nevada secondary MCLs.

[5] Value is action level for treatment technique for lead and copper.

Note: Bold values exceed Nevada Drinking Water Standards.

Source: Schafer 2011c.

concentrations are not expected to affect groundwater quality outside the footprint of the pits, infiltration from the North Pit under this alternative is not likely to adversely affect the water quality in the carbonate aquifer.

Pit Lake Water Quality

The long-term (400-year) predicted pit lake water chemistry for the Partial Backfill Alternative is summarized in **Table 3.4-12**. The predicted water quality for the North Pit lake is essentially the same as reported previously for the North Pit Lake under the Proposed Action. Therefore, impacts associated with this North Pit lake are the same as described under the Proposed Action.

3.4.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to water resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area would be conducted under existing authorizations. No additional ground-disturbing activities beyond those currently authorized would occur at the mine site.

Water Quantity Impacts

Impacts to Water Levels

After dewatering ceases at the BGMI facility, the groundwater levels in the carbonate aquifer would eventually rise above the bottom of the pit and result in the development of a pit lake. The development and predicted water quality of the pit lakes is discussed under the "Pit Lake Water Quality" section below.

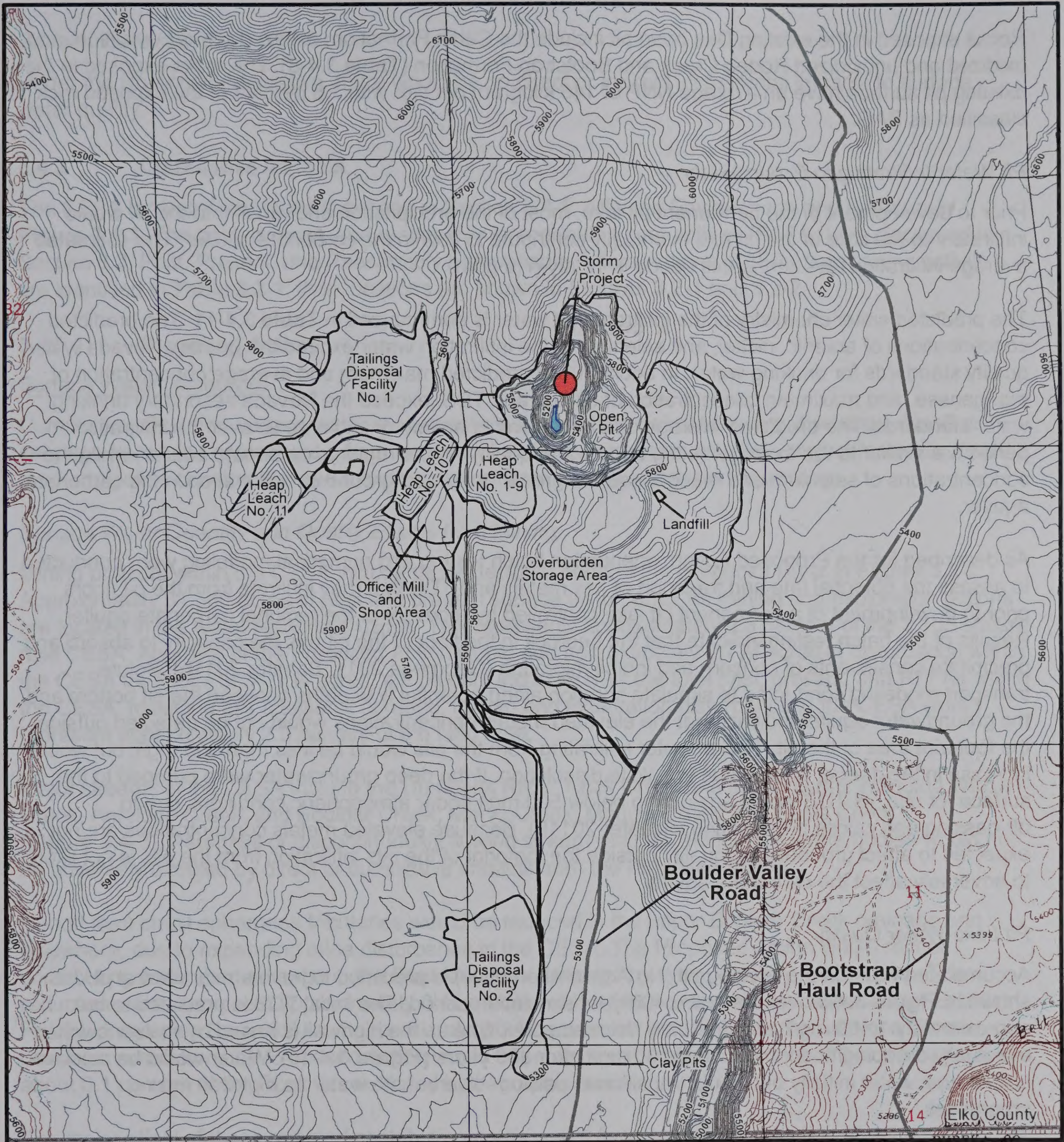
Impacts to Streams, Springs, and Seeps and Water Rights

Under the No Action Alternative, no impacts to perennial streams, springs, seeps would occur. In addition, impacts to the water rights identified in **Table 3.4-9** are not anticipated.

Pit Lake Development

Under the No Action Alternative, the existing Dee open pit would remain in its present configuration. The same methodology described for the proposed project in Section 3.4.2.1, Proposed Action, was used to evaluate the pit lake development and geochemistry of the No Action Alternative. The regional groundwater flow model was used to predict the development of the pit lake, as described in JSA (2010c). The flow modeling predicts that a shallow pond up to a few feet deep would initially form from the collection of runoff and groundwater inflow from local or perched aquifers. This shallow pond may be perennial, seasonal, or ephemeral (JSA 2010c). Any water ponded in the pit would be perched above the carbonate aquifer system during an estimated 330 years of recovery. The elevation of the recovering water levels in the carbonate aquifer is predicted to reach the bottom of the existing pit at about 330 years after dewatering ceases. At this time, flow from the carbonate aquifer into the pit would result in the development of a permanent pit lake. The pit lake would approach steady state conditions at approximately 400 years after cessation of pumping.

The final pit lake area under the No Action Alternative is illustrated in **Figure 3.4-13**; predicted surface area, volume, and depth of the pit lake are summarized in **Table 3.4-10**. Under this scenario, a single (small) pit lake would develop with a surface area of approximately 0.6 acre. An estimated 95 percent of the net inflow to the pit lake (8.6 gpm) would come from highwall runoff and the remainder from direct rainfall. Most of the water in the existing Dee open pit (approximately 80 percent) would infiltrate into the carbonate aquifer, and the remainder would evaporate.



Source: Schafer 2012a.

Arturo Mine Project EIS

Figure 3.4-13

Post-mining Pit Lake No Action

8/21/2012

Rocks exposed in the existing Dee open pit include the Carlin Formation; oxidized Vinini Formation; and oxidized and unoxidized Rodeo Creek and Bootstrap Formation (**Table 3.4-8**). The rocks exposed in the existing pit surface have an average NNP of 146 kilogram per liter with 1.8 percent of the exposed rock classified as PAG.

Pit Water Infiltrating to Groundwater

Prior to development of the permanent pit lake, most of the precipitation and runoff into the pit would infiltrate into the floor of the pit and eventually contribute to flow in the carbonate aquifer. The estimated average infiltration rate during this period is 12 afy (7.5 gpm).

The predicted water chemistry of the infiltrated pit water is summarized in **Table 3.4-11**. The predicted concentrations of arsenic, nickel, and selenium in the infiltration water exceed the primary Nevada water quality standards for drinking water. In addition, the predicted maximum and average concentration of manganese, and maximum concentration of sulfate and TDS, exceed the Nevada secondary drinking water standards. The predicted average concentrations of antimony and arsenic over the infiltration period are similar to the average background water quality for the regional carbonate aquifer, while the concentrations of selenium and manganese are greater than background concentration in the carbonate aquifer.

As described for the Proposed Action, attenuation batch testing and numerical modeling were conducted to assess the potential fate and transport of key metals and TDS that may infiltrate from the pit floors prior to development of a permanent pit lake controlled by recovery of the regional carbonate aquifer. Results of the batch testing indicate that the bedrock in the floor of the pit has the capacity to absorb and precipitate constituents of concern and inhibit migration (Geomega 2011; Schafer 2011b). Solute transport modeling conducted to simulate sorption along potential flow paths between the pit bottom and the groundwater aquifer indicate that the elevated metals concentrations would not be detected outside the footprint area of the pit. TDS of water infiltrating from the pits would be less than 500 mg/l, but would increase in the deeper aquifer due to calcite dissolution. If the deep groundwater were pumped to the surface for use, its TDS would again drop below 500 mg/l under atmospheric conditions due to off-gassing and calcite precipitation (Schafer 2011b). Because elevated metals concentrations are not expected to affect groundwater quality outside the footprint of the pits infiltration from the pits is not likely to adversely affect the carbonate aquifer.

Pit Lake Water Quality

Accumulated water in the existing pit (No Action Alternative) is predicted to have a near neutral pH, as shown in **Figure 3.4-9** over the entire 400-year simulation period. The initial TDS is predicted to be approximately 1,400 mg/l, and gradually decrease over time as the highwall is rinsed by meteoric water, eventually dropping to approximately 100 mg/l after 300 years (**Figure 3.4-10**). Water would be calcium-sulfate type water initially but would transition to calcium-bicarbonate water as highwall rinsing progresses.

The predicted pit lake water chemistry for the existing pit after 400 years is summarized in **Table 3.4-12**. The predicted pit lake water constituent concentrations exceed the Nevada water quality standards for antimony and arsenic. Unlike the proposed project pit lake, the No Action pit lake is not predicted to behave as a groundwater sink. At 400 years, the pit lake is predicted to have outflow to the carbonate aquifer system at a rate of approximately 10 afy (6 gpm). Although the predicted concentrations of arsenic (0.037 mg/l) and antimony (0.041 mg/l) exceed the Nevada drinking water standards, these predicted concentrations are similar to the average concentrations for antimony (0.035 mg/l), and arsenic (0.021 mg/l) that occur in the carbonate aquifer, and are within the range of concentration (antimony 0.022 to 0.055 mg/l; arsenic 0.008 to 0.451 mg/l) in the carbonate aquifer. Therefore, pit lake outflow is not expected to adversely affect the water quality of the downgradient aquifer system. The potential risk to wildlife associated with exposure to the pit lakes is addressed in Section 3.17, Wildlife and Aquatic Biological Resources.

Surface Water Quality

Under the No Action Alternative, there would be no direct or indirect incremental impacts to surface water quality.

3.4.3 Cumulative Impacts

The CESA for water resources is defined in Section 3.4.1, Affected Environment, and is shown in **Figure 3.4-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.4.3.1 Proposed Action

Surface Water Resources

Cumulative effects on surface water resources result from mine dewatering and discharge, runoff or seepage from mine components, from removal of surface water features within project footprints, from road or pipeline construction and maintenance, or from wildfire and livestock grazing.

Surface Water Quantity and Quality Effects from Mining

Mining projects within the CESA include those depicted north of the Humboldt River in **Figure 3.2-2**. Approximately 31,360 acres of past and present surface disturbance for mining and exploration actions are located in the water resources CESA. This represents approximately 2.3 percent of the 2,105 square mile CESA. Approval of the Proposed Action would add approximately 2,774 acres of disturbance within the CESA for a total of 34,134 acres, a 9 percent increase over the total past, present, and RFFAs within the CESA. Including this additional acreage, mining and exploration disturbance in the CESA would represent approximately 2.5 percent of the land area.

Major streams in the CESA include the Humboldt River; Rock Creek and its tributaries including Willow Creek, Antelope Creek, and Boulder Creek; Marys Creek; Maggie Creek; and Susie Creek (**Figure 3.4-3**). Perennial or discontinuously flowing stream reaches along these waterbodies would not be adversely affected by direct or cumulative impacts from the Proposed Action.

Runoff from small ephemeral tributaries would be reduced in the upper Boulder Creek drainage and elsewhere, due to expanding mine disturbance in the CESA. The Proposed Action would reduce contributing watershed acreage in the Boulder Creek drainage by approximately 1,626 acres. This reduction would represent approximately 0.45 percent of the 560 square miles of watershed in Boulder Flat (Hydrographic Basin 61), and approximately 0.12 percent of the CESA. In the Antelope Creek drainage, runoff from the Proposed Action would affect approximately 0.3 percent of that drainage, and about 0.1 percent of the Rock Creek Valley hydrographic basin.

The major effect of these reduced contributing areas would include a slight reduction of ephemeral flows from snowmelt and rainfall runoff in the CESA. These flows mostly occur in spring. Smaller flow rates and/or shorter flow durations may allow sediment build-up in affected tributary channels, and would reduce shallow groundwater availability in nearby alluvial deposits. Reduced recharge and soil moisture may adversely affect riparian systems. In parts of some streams such as Boulder Creek, lower Maggie Creek, lower Marys Creek, lower Susie Creek, and Antelope Creek, flow reductions could occur from mine-induced groundwater drawdown (BLM 2000b). Within the CESA, reduced ephemeral surface flow contributions would add to these impacts.

The Proposed Action would create disturbance in the Antelope Creek watershed in the northwestern part of the project area, within the Rock Creek Valley Hydrographic Basin. Runoff and seepage from the West WRDF would contribute to flow in small ephemeral tributaries of Antelope Creek. Direct flow impacts to Antelope Creek would be small, possibly unnoticeable, and would generate minor cumulative flow impacts on Antelope Creek.

Stream flows in Boulder Creek are ephemeral on Boulder Flat, and are generally removed from the channel by seepage and evapotranspiration. As discussed above in Section 3.4.1.2, Surface Water Resources, since there is no hydrologic connection of the Boulder Creek to the Rock Creek ditch or the Humboldt River there would be no cumulative surface water impacts from the proposed project.

In addition to these streamflow considerations, the Proposed Action would generate cumulative impacts to the overall number of springs and seeps. As described in previous NEPA documents (BLM 2008b, 2000b), approximately 130 springs and seeps were identified in the early 1990s in the Boulder, Bell, Brush, and Rodeo Creek drainages near the BGMI facility. Approximately 280 additional springs and 210 additional seeps were identified in the Willow Creek, Rock Creek, and Antelope Creek drainages. In the region around Newmont's Gold Quarry operations, 200 springs and seeps were identified. These features, identified from the earlier fieldwork and recent project-specific surveys, also are indicated in **Figure 3.4-3**.

Cumulative impacts to springs and seeps would occur within the CESA, since removal of these features would result from the Proposed Action. These impacts would add to existing and future impacts on springs and seeps, as described in other NEPA documents (BLM 2010a,b, 2008b, 2007a, 2000b). There are 67 identified spring sites located within the maximum extent of the 10-foot drawdown contour predicted by BGMI groundwater modeling (BLM 2003a). Flows from at least two of these springs that occur downstream along Boulder Creek have already ceased (AATA International 2006). These springs are the southernmost two indicated in **Figure 3.4-2**. Based on the analysis conducted in 2000, a total of 182 springs could be potentially impacted by mine dewatering in the Carlin Trend (BLM 2000b). However, recent assessments suggest that fewer springs/seeps could potentially be affected in the CESA overall (BLM 2010a,b, 2007a). In any case, the removal of springs and seeps during the Proposed Action would be an incremental addition to these impacts. Barrick and Newmont have existing obligations to mitigate mine dewatering effects on springs at selected locations in the CESA.

Cumulative surface water quality impacts could result from runoff and seepage from mining and exploration project components within the CESA. In general, these potential sources include leach pads, tailing ponds, mills and other process buildings, shops and warehouses, process fluid ditches and ponds, ore stockpiles, waste rock disposal facilities, drill pads and pits, and roads. The severity and extent of these impacts would be reduced or mitigated by project design and construction, and by compliance with regulatory programs and associated permit stipulations. Examples of such controls include ditches, pipelines and containment features to manage runoff and process fluids; storm water pollution prevention programs; and spill prevention and response programs. With the exception of Newmont's Ivanhoe Open Pit Mine Project, water monitoring stations within the CESA have not reported elevated concentrations of metals or acid rock drainage (BLM 2010a,b). At Newmont's Ivanhoe Open Pit Mine Project, mine drainage issues are being addressed through waste rock stockpile treatments and a constructed wetland. In general, cumulative long-term mining impacts to surface water quality would be reduced by waste rock management, compliance with closure and reclamation permits and related agreements, and by the implementation of monitoring and mitigation measures.

Surface water quality impacts could result in the CESA from incidental spills, from intensive storms overwhelming control features and creating bypasses, and by erosion and sedimentation events at mining sites (e.g., ditch or slope failures). These isolated occurrences would affect surface water quality in their immediate locales. Operator and agency responses, in the form of containment and mitigation, would limit the extent and severity of these incidental impacts.

Pit lakes that ultimately form at Gold Quarry, Betze/Post, Arturo, and other sites in the CESA are not anticipated to discharge to surface waters. They are expected to be "sinks," where water is lost to evaporation (BLM 2008b). Based on modeling at the Betze-Post Pit, predicted concentrations of TDS, sulfate, flouride, arsenic, cadmium, nickel, and antimony are anticipated to exceed Nevada drinking water standards (BLM 2008b). The pH of Betze-Post pit lake water is anticipated to be near neutral in the long term, but there is a potential that it may be acidic in the short term (BLM 2008b). The long-term pit lake water quality under the Proposed Action would also exceed drinking water standards for several constituents. It should be noted, however, that based on restricted access, wildlife support is anticipated to be the only beneficial use of pit lake waters in the CESA. The potential cumulative risk to wildlife from exposure to pit lakes is addressed in Section 3.17, Wildlife and Aquatic Biological Resources.

Effects from Other Watershed Conditions

Other sources of surface water impacts in the CESA include existing conditions from grazing, irrigated croplands, wildland fires, and road construction and maintenance. These also contribute to existing surface water conditions of surface water flow and quality.

Grazing has been the most extensive historic land use in the CESA, and this is expected to continue. Surface water impacts from grazing are both beneficial and adverse. The contributions and impacts of grazing have long been debated (e.g., Elko County Nevada 2010; Northeastern Nevada Stewardship Group, Inc. 2003; Resource Concepts 2001; West 1983). In summary, both beneficial and adverse effects from grazing are widespread in the CESA. Among others, these effects include additional herbaceous growth and diversity, livestock trampling in riparian areas, and reduced overall vegetative cover.

Irrigated agricultural lands occupy a small portion of the CESA (Section 3.19, Land Use and Access). Impacts to surface water include flow diversions from streams and springs, consumptive use by crops, and increased concentrations of TDS and agricultural chemicals in irrigation return flows.

Wildfires in the CESA also have increased erosion and sedimentation, with attendant increases in turbidity and concentrations of suspended solids, dissolved solids, and temperature in area streams and ponds. Fire extent in the CESA is depicted in **Figure 3.2-3**. Most of the CESA has been burned, sometimes repeatedly, since the year 2000. From a watershed viewpoint, the most significant effect of these wildland fires is the loss of vegetation cover, which can lead to adverse changes in hillslope hydrologic function through decreased infiltration, increased runoff, and reduced soil quality (Pierson et al. 2011, 2003). These conditions then lead to increased flooding, accelerated erosion, increased turbidity and sedimentation and increased nutrient loading in surface water (National Wildfire Coordinating Group 2001). Other effects of fire, and the potential for fire in the watersheds, are discussed in the vegetation and range management sections of the EIS.

Other disturbances in the CESA include the Ruby Pipeline, roads, and transmission lines. The Ruby Pipeline, a recently constructed natural gas pipeline, crosses about 28 miles of the Willow Creek Valley watershed. Assuming a disturbed width of 115 feet, approximately 390 acres were disturbed by the pipeline in the CESA. BMPs for backfilling, topsoil handling, revegetation, and erosion control would avoid or reduce runoff and erosion impacts from the proposed pipeline in the CESA.

The road network is extensive in the CESA. Potential cumulative impacts to runoff, erosion, and sedimentation are similar to those described for direct impacts. These existing effects include restricted drainage at road crossings of streams, modified drainage patterns, concentrated flow conditions that may accelerate erosion and sedimentation, sediment yielded from road maintenance, and water quality impacts from treatment chemicals (e.g., magnesium chloride) carried to nearby streams or riparian areas. These impacts affect streams such as Boulder Creek, Antelope Creek, Rock Creek, Willow Creek, Maggie Creek, Marys Creek, Susie Creek, and their tributaries. Generally the severity of these impacts diminishes with distance and increasing watershed area away from roads.

Groundwater Resources

The cumulative effects to water resources resulting from historic, present, and projected future dewatering activities for mines in the CESA were evaluated in detail in the CIA report for dewatering and water operations (BLM 2000b) and in the Betze Project, Draft Supplemental EIS (BLM 2000c). These impact evaluations used a calibrated numerical model to simulate the combined or cumulative hydrologic effects associated with dewatering and water management activities at existing and proposed mines.

Newmont Nevada Energy Investment, LLC (NNEI) operates the TS Power Plant in Boulder Valley. The power plant is a 242 MW coal-fired steam-turbine electric generation facility that commenced commercial power generation in June 2008. The design water requirement for the plant is approximately 2,400 gpm (the average water use since startup has averaged 1,400 gpm). The water required for the power plant is supplied from a primary production well located approximately 2 miles north of the plant site and two backup wells located closer to the plant. NNEI holds water rights to support TS Power Plant that allow a withdrawal rate of up to 5,565 gpm. The wells withdraw water from the alluvial basin fill aquifer in Boulder Valley. Depth to groundwater near the TS Power Plant varies from approximately 10 to 30 feet below surface. The alluvial water supply wells for the TS Power Plant operate outside of the area that is affected by drawdown associated with mine dewatering activities in the Carlin Trend. Therefore, water withdrawal for the TS Power Plant is unlikely to contribute to the cumulative drawdown associated with mine dewatering activities. Groundwater quality is acceptable for cooling water, which is the largest water use at TS Power Plant. NNEI maintains a potable water treatment system for arsenic removal and disinfection. Additionally, a reverse osmosis system with an associated ion exchange demineralizing circuit operated to produce boiler water (Laybourn 2012). Wastewater for the facility is discharged to four double-lined evaporation ponds managed in accordance to NDEP discharge permit requirements (NDWR 2011). Because the lined evaporative ponds are permitted as a zero-discharge facility, the TS Power Plant operation is not expected to impact surface or groundwater quality.

Expansion and deepening of the pit area would result in the development of three pit lakes, as discussed in Section 3.4.2.1, Proposed Action. The recently refined and recalibrated groundwater flow model (JSA 2010a) was used to evaluate the cumulative long-term effects of the pit lakes on the predicted maximum extent of drawdown. Specifically, this modeling evaluated the maximum extent of the 10-foot drawdown contour irrespective of time, as used in the earlier cumulative assessments. Cumulative results were generated for the No Action and Proposed Action pit lake scenarios. Comparison of the cumulative 10-foot drawdown for the No Action and Proposed Action scenarios indicated that the results are visually identical. The proposed project does not substantially change the predicted regional drawdown pattern because the pit lakes would be a minor influence on the regional groundwater flow system (JSA 2010a).

As described under the proposed project (Section 3.4.2.1, Proposed Action), water accumulated in the pit would infiltrate to the carbonate aquifer during the first 200 years after dewatering ceases. After that time, the pit would behave as a sink with no outflow to groundwater. The estimated average infiltration rate over this period would range up to 90 gpm (total from all three pit areas). The predicted average concentrations of the water quality constituents over the infiltration period are predicted to exceed the background water quality for the carbonate aquifer, and exceed some Nevada drinking water standards. However, the results of solute transport modeling indicate that elevated metals concentrations are not expected to affect groundwater quality outside the footprint of the pits, as summarized in Section 3.4.2.1, Proposed Action. Therefore, the Proposed Action is unlikely to contribute to cumulative impacts to groundwater quality.

3.4.3.2 Single Waste Rock Disposal Facility Alternative

Surface Water Resources

Cumulative impacts to surface water quantity and quality would be the same as those described for the Proposed Action.

Groundwater Resources

Potential cumulative impacts to groundwater resources under the Single WRDF Alternative would be essentially the same as those described for the Proposed Action.

3.4.3.3 Partial Backfill Alternative

Surface Water Resources

Cumulative impacts to surface water quantity and quality would be the same as those described for the Proposed Action.

Groundwater Resources

Potential cumulative impacts to groundwater resources under the Single WRDF Alternative would be essentially the same as those described for the Proposed Action.

3.4.3.4 No Action Alternative

Surface Water Resources

Under the No Action Alternative, no additional cumulative effects to surface water resources would occur. Cumulative effects to surface water quantity and quality would approximate those identified in previous NEPA assessments for the CESA (BLM 2010a,b, 2008b, 2007a, 2000b,c).

Groundwater Resources

After pit dewatering at the BGMI facility ceases the groundwater elevation in the carbonate aquifer would gradually rebound and eventually intercept the pit shell and form a permanent pit lake. The results of groundwater modeling indicate that this permanent pit lake would begin to develop 330 years after mining ceases. Prior to this time, water captured in the pit that does not evaporate would infiltrate into the carbonate aquifer. The estimated average infiltration rate during the first 330 years of water level recovery is 12 afy (7.5 gpm). The predicted average concentrations of the water quality constituents over the infiltration period are predicted to exceed the background water quality for the carbonate aquifer, and exceed some Nevada drinking water standards. Solute transport modeling indicates that elevated metals concentrations are not expected to affect groundwater quality outside the footprint of the pits. Therefore, the No Action is unlikely to contribute to cumulative impacts to groundwater quality. Other cumulative impacts to groundwater resources would be the same as described under the Proposed Action.

3.4.4 Potential Monitoring and Mitigation Measures

The following monitoring and mitigation measures are recommended for water resources and geochemistry. These measures would apply to both the Proposed Action and the Single WRDF Alternative.

3.4.4.1 Monitoring Measures

Issue: Sediment and other water quality constituents could collect in existing impoundments within the proposed project area or within proposed storm water catchments created during project operation, closure, or reclamation. The functions of these impoundments could be impaired due to loss of storage capacities.

Monitoring Measure SW-1. All existing impoundments and catch basins or impoundments which result from the proposed project or alternatives would be monitored for storage capacity.

The storage capacities of existing impoundments in the southwest quarter of Section 34 would be determined prior to the approval of the proposed project, and would be monitored and reported to the BLM annually thereafter. Monitoring at existing impoundments and storm water basins would be conducted as required by the NDEP Water Pollution Control Permit and the NDEP Storm Water General Permit, and reported to BLM.

Effectiveness: Monitoring Measure SW-1 would provide for periodic sampling and reporting of conditions at existing impoundments. Existing impoundments and proposed storm water catchments would be monitored for infilling and water quality trends prior to the start of closure and reclamation procedures. The monitoring activities could then be used to identify trends in catchment conditions, for modifying erosion control and reclamation procedures as needed, or for triggering mitigation.

Issue: Toe seepage could occur locally along the margin of the WRDF's during the operational phase due to potential preferential flow paths that may develop, snowmelt infiltration, and surface water runoff from the sloped area.

Monitoring Measure SW-2. Barrick Dee Mining Venture (BDMV) would develop a plan in conjunction with NDEP and BLM to identify and monitor the flow and water quality for measureable toe seepage along the margin of the WRDF's. The plan would include methodologies and procedures that would be used to identify toe seepage areas and then monitor the flow rates and collect and analyze leachate to determine if the samples exceed applicable water quality standards. The monitoring data would be evaluated by the NDEP and BLM and would be used to trigger mitigation (outlined in Mitigation Measure SW-2) if necessary.

Effectiveness: Development of a monitoring plan would identify areas of toe seepage and evaluate if the water quality of the seepage exceeds applicable standards.

Issue: Seeps and springs monitoring data for the proposed project would be incorporated into the BVMP.

Monitoring Measure SW-3. BDMV would assure that monitoring data from seeps, springs and other monitoring points within the proposed project area that are not currently included in the BVMP, would be evaluated for incorporation into the BVMP. BDMV will assure that the BVMP would be adjusted to include appropriate data.

Effectiveness: The BVMP would be updated with the proposed project monitoring results.

3.4.4.2 Mitigation Measures

Issue: Sediment and other water quality constituents could collect in existing impoundments within the proposed project area or within proposed storm water catchments created during project operation, closure, or reclamation. The functions of these impoundments could be impaired due to loss of storage capacities.

Mitigation Measure SW-1. If storage capacities of existing impoundments were found to be substantially reduced, as defined in coordination with the NDEP, additional mitigation would be implemented as determined by the agency. Such mitigation could take the form of: 1) remedial erosion control and sedimentation measures at source areas; 2) sediment testing, removal, and burial within a WRDF; 3) new construction of an impoundment at an offsite location; or 4) any combination of these or other measures.

Effectiveness: Mitigation Measure SW-1 would address potential impacts associated with the proposed storm water catchments, including loss of storage capacities.

Issue: Toe seepage could occur locally along the margin of the WRDF's during the operational phase due to potential preferential flow paths that may develop, snowmelt infiltration, and surface water runoff from the sloped area.

Mitigation Measure SW-2. If toe seepage is identified and water quality monitoring indicates that the seepage exceeds applicable water quality standards established by NDEP under the State Water Pollution Control Permit, BDMV would develop and implement site specific plan(s) in conjunction and with approval of NDEP and BLM to mitigate potential water quality impacts. The site specific mitigation plans would include measures to capture, control and treat the effluent; and monitor to verify mitigation effectiveness.

Effectiveness: Methods to capture, control, and treat small amounts of toe seepage from WRDFs are well known and easily implemented. Mitigation measure SW-2 would effectively mitigate impacts to water quality.

3.4.5 Residual Impacts

No residual impacts are anticipated for surface water resources. The existing streams are ephemeral and the contributing watershed areas are comparatively small and/or already disturbed. Control of process fluids and storm water would be required and monitored according to state and federal permits. The predicted infiltration of water from the pits that exceed some Nevada drinking water standards under both the Proposed Action and No Action alternatives is considered an unavoidable residual adverse impact to the local water quality of the carbonate aquifer.

3.5 Cultural Resources

3.5.1 Affected Environment

Cultural resources are definite locations of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional, cultural, or religious importance to specified social and/or cultural groups. Cultural resources are definitive, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing the resources for public benefit.

The study area for cultural resources includes the Area of Potential Effect (APE). Under Section 106 of the National Historic Preservation Act (NHPA), the APE is defined as "those areas in which impacts are planned or are likely to occur. Specifically, the APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. Additionally, the APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 Code of Federal Regulations [CFR] 800.16[d])."

The APE should include the following:

- All alternative locations for all elements of the proposed project;
- All locations in which the proposed project might result in ground disturbance;
- All locations from which elements of the proposed project (e.g., a facility or land disturbance) might be visible or audible;
- All locations in which the proposed project might change traffic patterns, land use, public access, etc.; and
- All areas in which direct or indirect effects might occur.

The APE for the proposed project encompasses the proposed Plan of Operations (PoO) boundary, and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occur outside of the proposed PoO boundary. Cultural resources located in the APE were reviewed to determine whether they would be subject to impacts that could affect their eligibility for the National Register of Historic Places (NRHP).

The Cumulative Effects Study Area (CESA) for cultural resources encompasses an area extending approximately 12.5 miles north, 25 miles south, 12 miles west, and 9.5 miles east of the proposed PoO boundary (**Figure 3.5-1**). The CESA boundary is designed to include areas within which artifacts made with or from Tosawihi opalite comprise the majority of material found at archaeological sites.

3.5.1.1 Regulatory Framework

Federal historic preservation laws provide a legal environment for documentation, evaluation, and protection of cultural resources that may be affected by federal undertakings. The National Environmental Protection Act (NEPA) states that federal agencies shall take into consideration impacts to the natural environment with respect to an array of resources, and that alternatives must be considered. The courts have made clear that cultural resources are regarded as part of the natural environment. The NHPA of 1966, as amended, established the Advisory Council on Historic Preservation and the NRHP. The NHPA mandates that federal agencies consider an undertaking's effects on cultural resources that are listed or eligible for listing on the NRHP, and Section 106 of the NHPA establishes a review process by which these resources are given consideration during the conduct of federal undertakings. Cultural resources that are listed or eligible for listing on the NRHP are referred to as historic properties.

3.5.1.2 Eligibility Criteria for Listing Properties on the NRHP

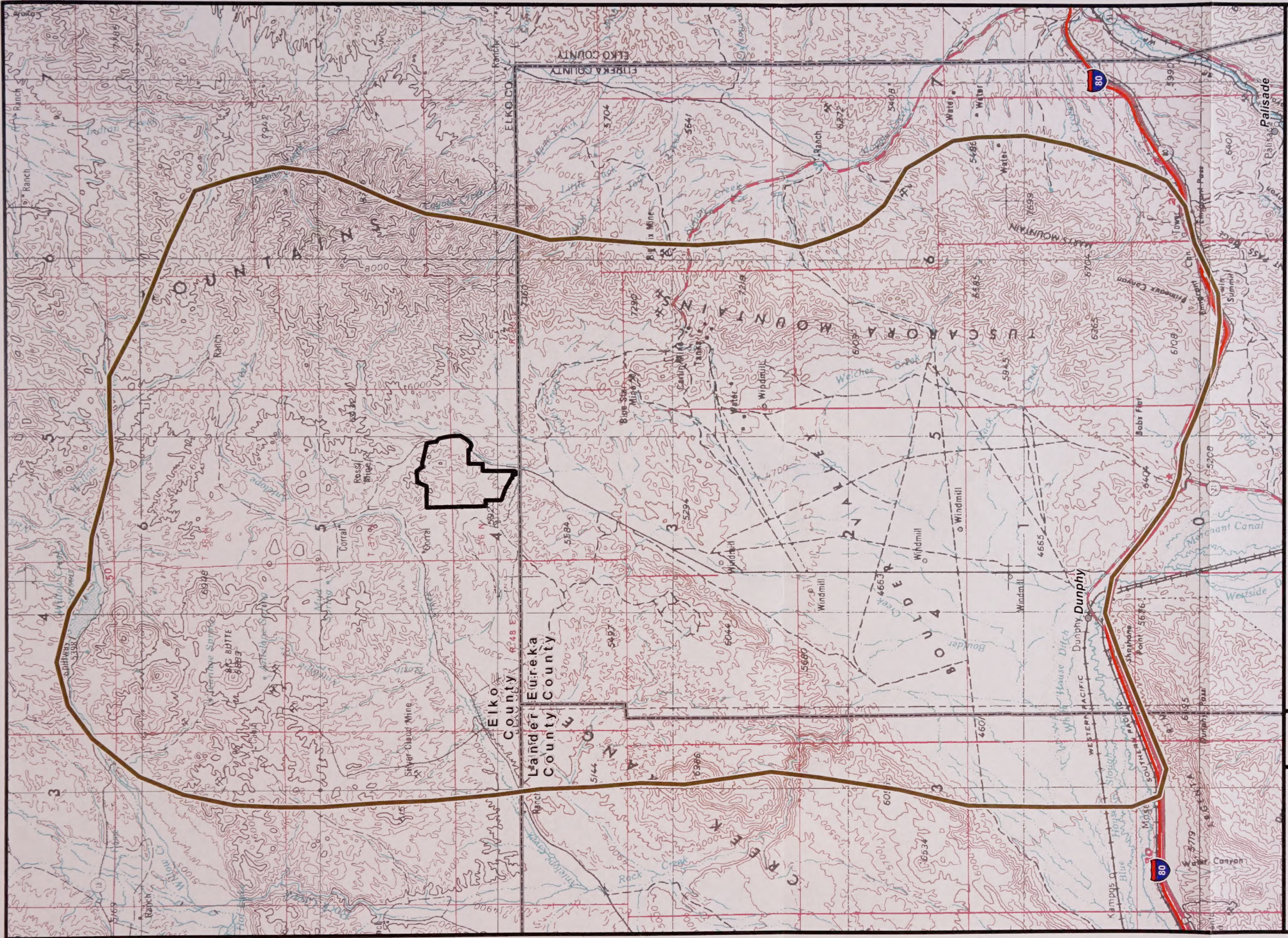
The NRHP, maintained by the National Park Service (NPS) on behalf of the Secretary of the Interior, is the nation's inventory of historic properties. The NPS has established three main standards that a property must meet to qualify for listing on the NRHP: age, integrity, and significance. To meet the age criteria, a property generally must be at least 50 years old. To meet the integrity criteria, a property must "possess integrity of location, design, setting, materials, workmanship, feeling, and association" (36 CFR 60.4). Finally, a property must be significant according to one or more of the following criteria:

- Criterion A – Be associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B – Be associated with the lives of persons significant in our history; or
- Criterion C – Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D – Have yielded, or may be likely to yield, information important in prehistory or history.

3.5.1.3 Cultural Overview

The study area lies within the eastern region of the Great Basin, which has a history of human occupation dating back to at least 12,000 years (Gilbert et al. 2008). In general, the earliest period of occupation within the region is the Paleoarchaic period. This period is characterized by prehistoric subsistence patterns that focused on hunting of large game, including now extinct fauna. Paleoarchaic materials are rare in the study area and surrounding region, which suggests a transient human presence in the area during this period (Schroedl and Tallman 1997). Approximately 8,000 to 10,000 years ago, as changing environmental conditions precipitated a decline in large game species, prehistoric populations came to rely more on a diversified subsistence strategy. This strategy consisted of hunting and gathering a wide variety of plants and animals and necessitated the adoption of a mobile lifestyle better suited to exploit a seasonal resource base (SWCA Environmental Consultants [SWCA] 2010a). This cultural period, known as the Archaic, remained essentially unchanged for thousands of years. Archaic-period sites have been documented in the study area.

The historic ethnographic record indicates that the study area lies within traditional Western Shoshone territory. The Western Shoshone, who occupied the area in the vicinity of Rock Creek, immediately west of the study area, were known as the Tosawihi, or White Knives, after the high quality white chert they quarried north of Antelope Creek (Tiley 2010a). The lifestyle of the Western Shoshone essentially was very similar to the Archaic people. Reports from early travelers and explorers who traveled through the region indicate that the Western Shoshone lived in small, family sized groups most of the year and traveled throughout the region exploiting the resources that became available on a seasonal basis. The material culture of both the Archaic and Western Shoshone was simple and utilitarian in nature, a practical adaptation for societies that moved frequently, but at times were more sedentary. In general, elements of their material culture included basketry; nets for fishing, rabbit drives, and duck hunting; rabbit-skin blankets for bedding and items of clothing; milling stones for processing seeds and other foods; flaked stone tools for hunting and processing game; and bows made of wood and strengthened with sinew (Bengston 2003). As a consequence of seasonal exploitation patterns, short-term periods of occupation, and a limited material culture, evidence of prehistoric occupation across the landscape typically is sparse.



Legend

Proposed PoO Boundary

Cumulative Effects Study Area

Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.5-1

Cultural Resources Cumulative Effects Study Area

05/16/2012

Since the 1860s, mining has been a prominent theme in the history of the region around Boulder Flat. Placer gold was discovered at Tuscarora in 1867, and vein gold and silver were found a few years later. At various times through the years, copper, silver, gold, and lead were all mined in the area. Most of these mines were over the Tuscarora Mountains to the east and southeast in the Maggie Creek, Lynn, and Richmond districts. From 1915 to 1944, mercury also was mined in the vicinity of Antelope Creek (Granger et al. 1957). Barite was a mineral that brought mining activity to the area, the most notable example being the Rossi Mine where claims were first staked in 1937. In 1964, a flotation mill was constructed in Dunphy for processing ore from the Rossi Mine. The flotation mill has since been reclaimed; mining activities continue at the Rossi Mine. Cordex Exploration Company conducted exploration activities in the project area from 1981 to 1983. In 1983, Dee Gold Mine Company obtained control of the mining claims within the project area, and in 1984 they began open-pit gold production. For an expanded discussion of Dee Gold Mine history, the reader is referred to Section 2.2, Project Background.

3.5.1.4 Class I (Files Search) Inventory

In March 2010, a Class I files search was conducted through the Nevada Cultural Resources Information System (NVCRIS) to identify all previously conducted archaeological investigations and previously recorded cultural resources within the files search area. The files search area encompassed the PoO boundary, a segment of the powerline corridor outside of the PoO boundary, and the Bootstrap Haul Road (SWCA 2011). A 0.5-mile buffer extending beyond the PoO boundary, powerline corridor, and Bootstrap Haul Road also was included in the files search area. In addition, the files at the Bureau of Land Management (BLM) Tuscarora Field Office were reviewed to obtain any information on cultural resources in the Class I files search area not available through NVCRIS.

A total of 162 archaeological sites have been previously recorded within the PoO boundary and 97 have been previously recorded outside of the PoO boundary, but within the 0.5-mile buffer. Of the 162 sites within the PoO boundary, 23 are eligible for the NRHP and 139 are not eligible. For those 97 sites located outside of the PoO boundary, but within the 0.5-mile buffer, 25 are eligible for the NRHP, 69 are not eligible, and 3 are unevaluated. Only two archaeological sites have been previously recorded along the segment of the powerline corridor that falls outside of the PoO boundary. Both sites are not eligible for the NRHP. A total of 23 archaeological sites have been previously recorded along the Bootstrap Haul Road and 144 archaeological sites have been previously recorded outside of the road, but within the 0.5-mile buffer. Of the 23 archaeological sites along the road, 4 are eligible and 19 are not eligible. For those 144 archaeological sites located in the 0.5-mile buffer of the road, 13 are eligible and 131 are not eligible (SWCA 2011).

Of the total number of NRHP-eligible sites previously identified through the Class I files search, 29 are located either in or adjacent to proposed disturbance areas. Data recovery was recommended for all of the 29 NRHP-eligible sites (**Table 3.5-1**). Of these, 25 are located within or adjacent to the PoO boundary and four are along the Bootstrap Haul Road. A Historic Properties Treatment Plan (HPTP) has been completed for the 25 sites within or adjacent to the PoO boundary and has been reviewed and approved by the BLM and Nevada State Historic Preservation Office (SHPO). A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to the SHPO for review.

3.5.2 Environmental Consequences

Primary issues pertaining to historic properties located within the proposed project area include ground-disturbing activities associated with construction of the proposed project and effects to unknown historic properties that may be discovered during project construction.

Table 3.5-1 Historic Properties within and Adjacent to the PoO Boundary and Along the Bootstrap Haul Road

Agency Number	Site Type	Project Element	Management Recommendation
CRNV-12-7103*	Prehistoric Lithic Scatter	Bootstrap Haul Road	Data Recovery
CRNV-12-7364*	Prehistoric Lithic Scatter	Bootstrap Haul Road	Data Recovery
CRNV-12-7368*	Prehistoric Lithic Scatter	Bootstrap Haul Road	Data Recovery
CRNV-12-8707	Prehistoric Lithic Scatter with Possible Hearth	PoO Boundary	Underwent treatment – no longer eligible
CRNV-12-8720	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-8729	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-8766	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-8784	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-8801	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10448	Prehistoric Lithic Scatter	PoO Boundary/ Bootstrap Haul Road	Data Recovery
CRNV-12-10449	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10462	Prehistoric Lithic Scatter with Groundstone	PoO Boundary	Data Recovery
CRNV-12-10464	Prehistoric Lithic Scatter with Groundstone	PoO Boundary	Data Recovery
CRNV-12-10465	Prehistoric Open Lithic Scatter	PoO Boundary	Underwent treatment – no longer eligible
CRNV-12-10485	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10529	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10540	Prehistoric Lithic Scatter with Groundstone	PoO Boundary	Data Recovery
CRNV-12-10541	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10543	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10766	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-10769	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-12265	Prehistoric Artifact Scatter	Adjacent to PoO Boundary	Data Recovery
CRNV-12-12266	Prehistoric Lithic Scatter	Adjacent to PoO Boundary	Data Recovery
CRNV-12-12288	Prehistoric Artifact Scatter	Adjacent to PoO Boundary	Data Recovery
CRNV-12-12289*	Prehistoric Lithic Scatter with Groundstone and Incised Stone	Bootstrap Haul Road	Data Recovery
CRNV-12-14509	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery

Table 3.5-1 Historic Properties within and Adjacent to the PoO Boundary and Along the Bootstrap Haul Road

Agency Number	Site Type	Project Element	Management Recommendation
CRNV-12-14511	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-14522	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-14529	Prehistoric Lithic Scatter	PoO Boundary	Data Recovery
CRNV-12-14530	Prehistoric Lithic, Groundstone, and Fire-altered Rock Scatter	PoO Boundary	Data Recovery
CRNV-12-14961	Prehistoric Single Use Campsite	PoO Boundary	Data Recovery

* Not included in the current Historic Properties Treatment Plan.

Source: SWCA 2010b.

Section 106 of the NHPA requires that federal agencies take into account the effect of an undertaking on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment. Historic property, as defined by the regulations that implement Section 106, means "any prehistoric or historic district, site, building, structure, or object included, or eligible for inclusion, in the NRHP maintained by the NPS." The term includes properties of traditional religious and cultural importance to any Native American tribe that meet the National Register criteria.

Potential impacts to historic properties are assessed using the "criteria of adverse effect" (36 CFR 800.5[a][1]): "An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." There are five broad categories of effect:

1. Physical destruction or alteration of a property or relocation from its historic location;
2. Isolation or restriction of access;
3. Change in the character of the property's use or of physical features within the property's setting, or the introduction of visible, audible, or atmospheric elements that are out of character with the significant historic features of the property;
4. Neglect that leads to deterioration or vandalism; and
5. Transfer, sale, or lease from federal to non-federal control, without adequate and legally enforceable restrictions or conditions to ensure the preservation of the historic significance of the property.

Under NEPA, effects to historic properties can be direct or indirect. Direct effects are caused by an undertaking and occur at the same time and place (40 CFR 1508.8[a]). These types of effects to historic properties include physical damage resulting from surface-disturbing activities and can occur to both known sites and subsurface sites. Indirect effects are caused by an undertaking and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). These types of effects often are not quantifiable and can occur both within and outside of the APE. In general, indirect effects to historic properties include, but are not limited to, changes in erosion patterns due to construction activities, and illegal artifact collection due to increased access to an area.

3.5.2.1 Proposed Action

Potential Effects

Surface disturbance associated with development of the mine, construction of ancillary and support facilities, and widening of the existing Bootstrap Haul Road could result in direct effects to historic properties. These effects could result in the vertical and horizontal displacement of soil containing cultural resources and the resulting loss of integrity, loss of information, and alteration of a site's setting.

The potential for the discovery of unanticipated archaeological deposits during construction activities exists within newly proposed disturbance areas and could result in direct effects. Unanticipated discoveries could result in displacement or loss (either complete or partial) of the discovered material. Displacement of archaeological deposits affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric settlement and subsistence patterns.

Resolution of Effects

The entire study area has been inventoried to Class III standards and all documented archaeological sites have been evaluated for eligibility to the NRHP. A total of 29 historic properties were documented either within or immediately adjacent to proposed disturbance areas. Of these, 25 are located within or adjacent to the PoO boundary and four are located along the Bootstrap Haul Road. A BLM and SHPO-approved HPTP has been prepared for the 25 properties located within or adjacent to the PoO boundary. Treatment of the 25 sites consisted of controlled, scientific study of archaeological deposits involving site mapping and surface artifact collection, test and possibly block excavations, and laboratory analysis. A HPTP for the remaining four historic properties located along the Bootstrap Haul Road has been developed to mitigate effects associated with widening of the road.

A Memorandum of Agreement (MOA) among the BLM, Nevada SHPO, and Barrick Dee Mining Venture has been developed for the proposed project. The MOA outlines treatment to mitigate unavoidable adverse effects to historic properties located in proposed disturbance areas; identifies who would be responsible for carrying out the agreed upon mitigation; and, provides documentary evidence that the BLM has met the requirements of Section 106. Once treatment is completed at the historic properties, compliance with Section 106 of the NHPA would be complete unless previously unknown historic properties or human remains are discovered during project construction.

As provided in the applicant-committed environmental protection measures, if any previously unknown archaeological sites or human remains are discovered during construction, all construction activities would immediately cease within 300 feet of the discovery, and the BLM Authorized Officer would be notified of the find. Steps would be taken to protect the site from vandalism or further damage until the BLM Authorized Officer evaluated the nature of the discovery. Construction would not resume in the area of the discovery until the BLM Authorized Officer issued a Notice to Proceed.

3.5.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. An additional five archaeological resources would be affected by expansion of the West WRDF. All five of the resources are prehistoric isolates, which by definition are not eligible for inclusion on the NRHP. Alternatively, four ineligible prehistoric lithic scatters located in the East WRDF would not be affected under this alternative. Other effects on cultural resources under this alternative would be the same as described for the Proposed Action.

3.5.2.3 Partial Pit Backfill Alternative

Potential impacts to cultural resources from the development of the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.5.2.4 No Action Alternative

The development of new facilities and implementation of the mining plan that comprise the proposed project would not occur under the No Action Alternative. The No Action Alternative would include completion of the closure and reclamation of the existing mine disturbance and reclamation of the surface exploration activities under the terms of the current permits and approvals. Data recovery currently recommended for 29 historic properties located within proposed disturbance areas have been or would be completed.

3.5.3 Cumulative Impacts

The CESA for cultural resources is defined in Section 3.5.1, Affected Environment, and is shown in **Figure 3.5-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.5.3.1 Proposed Action

Compliance with Section 106 of the NHPA has not minimized mining-related impacts to cultural resources located within the CESA, but rather has brought attention to the fact that impacts are occurring to these resources. Damage to cultural resources has occurred as a result of mining and continues to occur. Cultural resources inventories are conducted in response to proposals to mine on public land. Cultural resource inventories are completed by professional archaeologists who meet BLM and SHPO requirements prior to any mining-related disturbance. Results of the inventories are documented in inventory reports submitted to the BLM, including recommendations of site eligibility and potential project effects to sites recommended as eligible for the NRHP. The BLM reviews the archaeologist's recommendations when making final determinations of site eligibility and project effects. The inventory reports, along with BLM's final determinations are submitted to the SHPO for review and inclusion into the statewide database.

Avoidance of sites determined eligible for the NRHP is the preferred mitigation measure when sites are threatened by proposed disturbance. When possible, mining-related facilities are redesigned to avoid NRHP-eligible sites. However, avoidance is not always possible. In such cases, archaeological excavation (data recovery) by professional archaeologists is undertaken to mitigate adverse effects. The archaeologists prepare treatment plans, which include the methodology for data recovery and specific scientific issues to be addressed as a result of the excavation for submittal to the BLM. Approved plans are submitted by the BLM to the SHPO for review and concurrence. After final approval by the BLM, excavation and field work are conducted in accordance with the approved plan.

In some instances, the mines have reported damage to cultural resources inadvertently discovered during mining-related activities. However, in most instances, the damage has not been found until the cultural sites were revisited by archaeologists. Treatment of damaged cultural sites has rarely occurred. In compliance with Section 106 of the NHPA, cultural resources investigations were conducted for the Proposed Action. A total of 25 historic properties were identified in proposed disturbance areas within or adjacent to the PoO boundary and four were identified along the Bootstrap Haul Road. Unavoidable adverse effects to the 25 historic properties located within or adjacent to the PoO boundary have been mitigated through the BLM and SHPO-approved HPTP. A HPTP has been developed for the four remaining properties located along the Bootstrap Haul Road. Although adverse effects to these historic properties would be mitigated through data recovery, some of the data about the properties would be lost. Archaeological excavations of numerous sites currently are being conducted at many mines and other past, present, and RFFAs (e.g., utility and energy development) within the CESA; consequently, a substantial portion of the archaeological record would no longer be available for public interpretation or future investigations. Over time, this represents a cumulative effect – outcomes that are still present despite mitigation (treatment) of NRHP-eligible sites.

Future federal undertakings within the CESA would require compliance with Section 106 of the NHPA. Avoidance through project redesign would be the preferred method of mitigation; however, when avoidance is not possible, data recovery most likely would be implemented to mitigate adverse effects to NRHP-eligible sites. As stated previously, a principal disadvantage of data recovery is that much of the data about site would be lost, and a portion of the archaeological record would no longer be available for public interpretation and for future investigations. As more sites located within the CESA are excavated through the process of data recovery, incremental losses of archaeological information would continue.

3.5.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects to cultural resources associated with the Proposed Action.

3.5.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.5.3.4 No Action Alternative

Cumulative effects under the No Action Alternative would be similar to cumulative effects to cultural resources discussed above for the proposed project. However, an increase in cumulative effects associated with vandalism and illegal collecting of artifacts are anticipated under the No Action Alternative as data recovery have occurred or would occur at 29 historic properties.

3.5.4 Potential Monitoring and Mitigation Measures

A total of 25 historic properties identified within or adjacent to the PoO boundary that cannot be avoided by project construction have been mitigated in accordance with the HPTP. A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to the SHPO for review. Any previously unknown historic properties that may be discovered during construction activities would be treated in accordance with the applicant-committed environmental protection measures. No additional mitigation or monitoring is recommended for cultural resources.

3.5.5 Residual Impacts

The proposed project would result in the loss of cultural resources that are not eligible for the NRHP. Although these sites would be recorded to BLM standards and the information integrated into local and statewide databases, the sites ultimately would be destroyed by project construction. Adverse effects to 25 historic properties identified within or adjacent to the PoO boundary have been mitigated through data recovery in accordance with the HPTP. A HPTP has been developed for four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to SHPO for review. Although these historic properties would be mitigated through implementation of data recovery, some of the cultural value associated with these sites cannot be fully mitigated; therefore, it is anticipated that residual impacts would occur to these resources.

3.6 Native American Traditional Values

Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. In general, ethnographic resources include places in oral histories or traditional places, such as particular rock formations, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places used for religious practices; social or traditional gathering areas, such as dance areas; natural resources, such as plant materials or clay deposits used for arts, crafts, or ceremonies; and places and natural resources traditionally used for non-ceremonial uses, such as trails or camping locations.

3.6.1 Affected Environment

The study area for effects to Native American traditional values encompasses the proposed Plan of Operations (PoO) boundary; and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occur outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for Native American traditional values encompasses an area extending approximately 13.5 miles north, 31.5 miles south, 16 miles west, and 18.5 miles east of the proposed PoO boundary (**Figure 3.6-1**). The Tosawihi Quarry is a major source of artifact material in the area, and this material is prevalent in archaeological sites throughout the Northern Great Basin. The CESA boundary was designated to include an overall geographic area that is centered at the Tosawihi opalite quarry site extending outward until Tosawihi opalite artifacts are no longer the primary constituent of archaeological sites.

3.6.1.1 Regulatory Framework

Federal law and agency guidance require Bureau of Land Management (BLM) to consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on BLM-administered lands. This consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to:

- Locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world;
- Locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice;
- Ancestral habitation sites;
- Trails;
- Burial sites; and
- Places from which plants, animals, minerals, and waters believed to possess healing powers or used for other subsistence purposes, may be taken.

Some of these locations may be considered sacred to particular Native American individuals or tribes.

In 1992, the National Historic Preservation Act (NHPA) was amended to explicitly allow that "properties of traditional religious and cultural importance to an Indian tribe may be determined to be eligible for inclusion on the National Register of Historic Places." If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property (TCP). The term "traditional cultural property" first came into use within the federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. To qualify for nomination to the National Register of Historic Places (NRHP), a TCP must:

Be more than 50 years old;

- Be a place with definable boundaries;
- Retain integrity; and
- Meet certain eligibility criteria as outlined for cultural resources in the NHPA (Section 3.4, Cultural Resources).

In addition to NRHP eligibility, some places of cultural and religious importance also must be evaluated to determine if they should be considered under other federal laws, regulations, directives, or policies. These include, but are not limited to, the Native American Graves Protection and Repatriation Act of 1990, American Indian Religious Freedom Act of 1978, Archaeological Resources Protection Act (ARPA) of 1979, and Executive Order (EO) 13007 (Sacred Sites) of 1996.

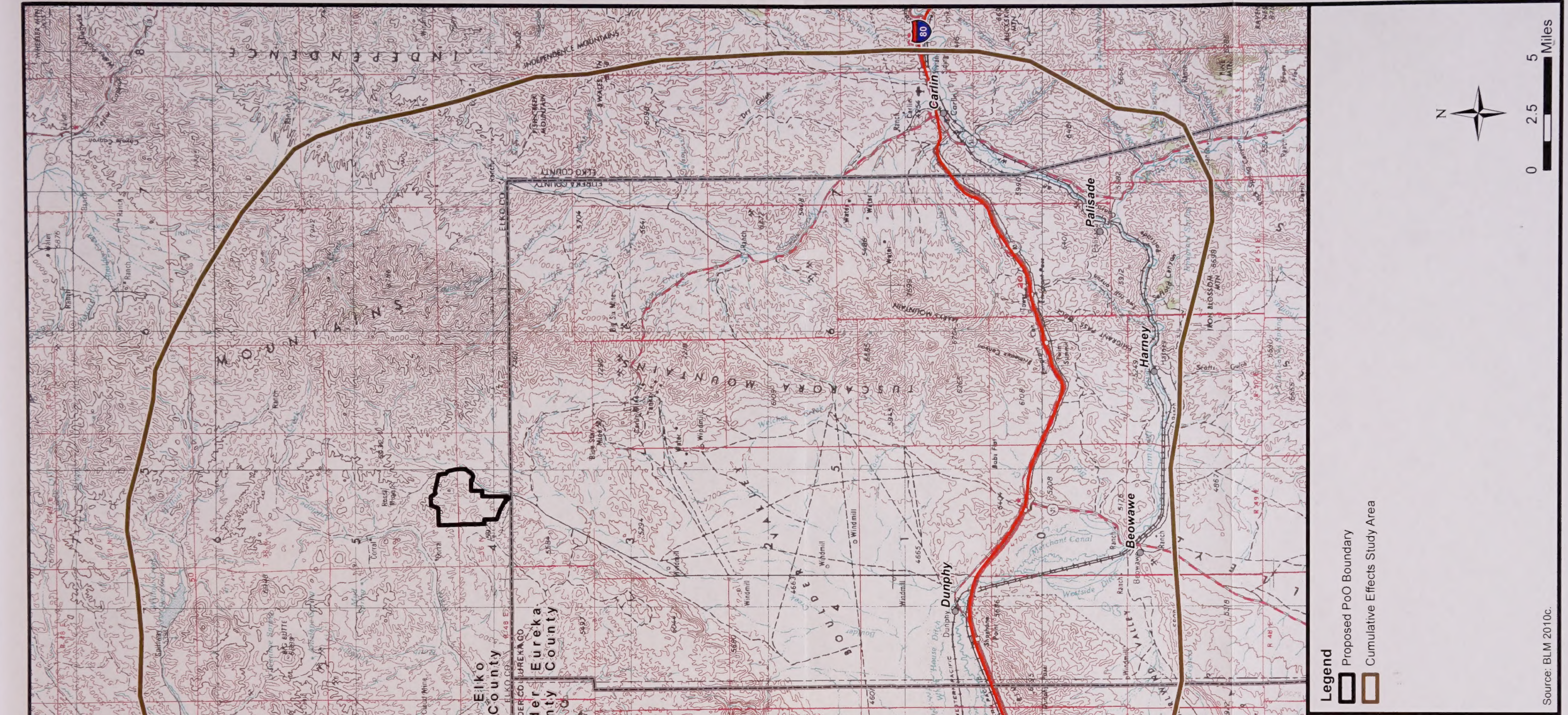
3.6.1.2 Native American Consultation

From 1991 to 1997, the BLM Elko District Office consulted and shared information with the groups listed in **Table 3.6-1** as part of the earlier Dee Gold Mine. Consultation and communication with these groups included letters, phone calls, and at least two field visits (January and February 1997) to the mine area with tribal elders and governments. During the communication and consultation efforts, the tribes expressed concerns about potential mining effects to TCPs and connections with the Tosawihi Quarries.

On July 20, 2009, the BLM Elko District Office mailed letters to the same groups listed in **Table 3.6-1** requesting consultation and information prior to issuance of an ARPA permit. The purpose of the permit was to implement a treatment plan involving archaeological excavation (data recovery) of site CRNV-12-10465, a small prehistoric lithic scatter recommended as eligible for the NRHP. No comments or concerns regarding the treatment plan were received from any of the contacted groups. Subsequently, the BLM Tuscarora Field Office notified the BLM State Archaeologist that consultation with the tribes and interested parties regarding the treatment plan had been initiated, but no concerns were received. The ARPA permit was then issued to the archaeological subcontractor, and data recovery was completed in fall 2009. No features were located during data recovery, and the BLM subsequently determined that the site was not eligible for the NRHP.

The BLM Elko District Office initiated government-to-government consultation for the Arturo Project Environmental Impact Statement (EIS) on October 1, 2009, by sending letters to the tribes, councils, and bands listed in **Table 3.6-1**. Letters were sent to inform the various groups of the proposed undertaking and to solicit any concerns they may have regarding places of cultural and religious importance or TCPs. In addition, the BLM sent letters to the Bureau of Indian Affairs, Western Shoshone Defense Project, Western Shoshone Descendants of Big Smokey, and Western Shoshone Committee of Duck Valley to inform them of the project. A map of the proposed project was included with the letters.

On June 22, 2010, the BLM Elko District Office sent letters to the groups listed in **Table 3.6-1** requesting comments prior to issuance of an ARPA permit to conduct data recovery at site CRNV-12-08707, a NRHP-eligible prehistoric lithic scatter. Subsequent to the letter, the BLM Elko District Office spoke with the Chairman of the Te-Moak Council regarding data recovery at CRNV-12-08707. The Chairman stated that although he could not speak for the Council or the rest of the tribe, he had no concerns with going forward with the data recovery with the understanding consultation would continue for the proposed project, including field tours to visit places of potential concern to the tribes, and meetings as additional sites are proposed for data recovery. In an email sent to the BLM Elko District Office dated August 10, 2010, a representative of the Tribal Council of the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation requested consultation on CRNV-12-08707. At that time, the ARPA permit had been issued for the data recovery as detailed in the BLM and State Historic Preservation Office (SHPO)-approved treatment plan. No other comments were received from the other tribes, bands, councils, or interested groups.



Arturo Mine Project EIS

Figure 3.6-1

Native American Traditional Values Cumulative Effects Study Area

05/16/2012

Table 3.6-1 Summary of Native American Consultation for the Arturo Project EIS (Consultation is Ongoing)

Native American Groups	Initial Contact (Letter) for the Arturo PoO and EIS	Follow-up Contact	Concerns/Comments
Battle Mountain Band	October 1, 2009	February 25, 2010 – BLM attends Band Council Meeting; project information and maps provided by BLM. June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties. October 1, 2010 – Field tour of study area.	Concerns include dewatering effects; artifacts collected during data recovery would not remain at a local repository; waste rock pile would erase evidence of traditional use of the area.
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. August 27, 2010 – Field tour of study area. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties. Additional consultation between BLM managers and tribe as part of monthly council meetings in September and October 2010.	Concerns include damage to archaeological sites; data recovery ultimately destroys sites; dewatering effects; flagging left by archaeological crews.
Elko Band	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Duckwater Shoshone Tribe	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Ely Shoshone Tribe	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.

Table 3.6-1 Summary of Native American Consultation for the Arturo Project EIS (Consultation is Ongoing)

Native American Groups	Initial Contact (Letter) for the Arturo PoO and EIS	Follow-up Contact	Concerns/Comments
Goshute Business Council	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
South Fork Band	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Te-Moak Council	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Wells Band	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Yomba Shoshone Tribe	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Interested Parties			
Bureau of Indian Affairs	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707.	No comments to date.
Western Shoshone Committee	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.

Table 3.6-1 Summary of Native American Consultation for the Arturo Project EIS (Consultation is Ongoing)

Native American Groups	Initial Contact (Letter) for the Arturo PoO and EIS	Follow-up Contact	Concerns/Comments
Western Shoshone Defense Project	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. September 2, 2010 – Letter sent regarding proposed data recovery at 25 historic properties.	No comments to date.
Western Shoshone Descendents of Big Smokey	October 1, 2009	June 22, 2010 – Letter sent regarding issuance of ARPA permit for CRNV-12-08707. August 27, 2010 – Field tour of study area.	Concerns include damage to archaeological sites; data recovery ultimately destroys sites; dewatering effects; flagging left by archaeological crews.

Source: Fawcett 2010; Tiley 2010b.

On August 27, 2010, the BLM Elko District Office, Barrick Dee Mining Venture (BDMV), and representatives of Duck Valley and Big Smokey Descendents conducted a field tour of the study area. During the field tour, the representatives shared ethnographic information pertaining to the historic use of the area by Western Shoshone, as well as information on previous water sources where Western Shoshone would fish. During the tour, the representatives and BLM discussed the proposed treatment of 25 historic properties to mitigate adverse effects of project construction. Although mitigation through data recovery is not favored by Western Shoshone because the site ultimately would be destroyed, the representatives felt that data recovery was better than the sites being damaged should avoidance fail (Tiley 2010b). Concerns expressed by the representatives included the effects of dewatering due to mining, and the possibility that archaeological crews would leave flagging or other locational markers that could alert the public to site locations. Although the representatives had no specific objections to the proposed project, they requested ongoing dialog with the BLM, monitors during any data recovery, and measures to minimize potential looting (Tiley 2010b).

On September 2, 2010, the BLM sent a letter to the Native American groups listed in **Table 3.6-1**, as well as to the Western Shoshone Committee and Western Shoshone Defense Project informing them of proposed data recovery at 25 NRHP-eligible prehistoric sites located in proposed disturbance areas.

In the letters and during the field tours and meetings, the BLM informed the tribes/bands that proposed data recovery at the 25 NRHP-eligible sites would address only archaeological concerns, while mitigation of other elements of cultural resources would require proposals or input from the tribal groups. To date, no input or response has been received from the tribal groups.

On October 1, 2010, representatives of the Battle Mountain Band attended a field tour of the study area with the BLM and BDMV. The representatives were shown the locations of several NRHP-eligible sites that would undergo data recovery to mitigate the effects of project construction. Many of the representatives stated that data recovery would not be satisfactory mitigation because the artifacts would be shipped off to Carson City rather than remain at a local repository. Also of concern were dewatering effects of the proposed project and other nearby mines, as well as effects associated with the waste rock pile and its potential to "wipe out" evidence of Western Shoshone ancestral use of the area. The tribal representatives indicated they do not approve of the proposed mining activities, but they wish to stay engaged in future discussions regarding the proposed project and provide input to the BLM (Tiley 2010b).

As part of the tribal coordination, communication, and consultation efforts, an ethnographic report was prepared for the Arturo Project (Tiley 2010b). The purpose of the ethnographic report was to summarize Native American concerns regarding the proposed project and to update existing ethnographic information on Western Shoshone traditional use of the study area. Previous ethnographic documentation available online, at the BLM, and at state repositories was reviewed to develop the ethnographic overview of the area. Additionally, consultation between tribal governments and the BLM conducted for previous mining activities in and near the study area was examined to provide a reference point for current tribal concerns. In order to update previous ethnographic documentation and to solicit concerns relative to the currently proposed project, the report author met with tribal individuals, attended tribal meetings, and participated in the two field visits to the study area.

3.6.2 Environmental Consequences

The NEPA process does not require a separate analysis of impacts to religion, spirituality, or sacredness. As a result, references in the analysis to such beliefs or practices convey only the terminology used by participants involved in the ethnographic study and tribal consultation and coordination conducted for the proposed project. This terminology does not reflect any BLM evaluation, conclusion, or determination that something is or is not religious, sacred, or spiritual in nature, but conveys only the information that has been gathered through tribal consultation and coordination and the ethnographic study.

The primary issues for the effects analysis were identified based on the information provided by the tribes during Native American consultation, communication, and coordination. Impacts to Native American traditional values would be considered significant if the proposed project would result in adverse effects to TCPs or places of cultural and religious importance to Indian tribes.

The effects of federal undertakings on properties of religious or cultural significance to contemporary Native Americans are given consideration under the provisions of EO 13007, American Indian Religious Freedom Act, and recent amendments to the NHPA. As amended, the NHPA now integrates Indian tribes into the Section 106 compliance process and also strives to make the NHPA and National Environmental Policy Act procedurally compatible. Furthermore, under Native American Graves Protection and Repatriation Act, culturally affiliated Indian tribes and the BLM jointly may develop procedures to be taken when Native American human remains are discovered on federal land.

3.6.2.1 Proposed Action

Potential Effects

Tribal representatives expressed concerns about potential damage to archaeological sites, and that mitigation through data recovery is not favored because the sites ultimately would be destroyed. In addition, there were concerns that archaeological crews would leave flagging that could alert the public to site locations, as well as concerns about dewatering effects to springs and effects associated with the waste rock and its potential to “wipe out” evidence of Western Shoshone ancestral use of the study area. Some tribal representatives had no specific objections to the proposed project, while others indicated disapproval of the proposed mining activities, ongoing dialog with the BLM, tribal monitors during any data recovery, and measures to minimize potential looting were requested by the tribal representatives.

Resolution of Effects

Impacts to Archaeological Sites

A total of 29 NRHP-eligible prehistoric sites are located either within or immediately adjacent to proposed disturbance areas. A BLM and SHPO-approved Historic Properties Treatment Plan (HPTP), which details the data recovery (archaeological excavation) methodology, was developed for 25 of the 29 NRHP-eligible sites. A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to the SHPO for review. Under the HPTP, data recovery would consist of controlled, scientific study of archaeological deposits involving site mapping and surface artifact collection, test and possibly block excavations, and laboratory analysis. In compliance with the applicant-committed environmental protection measures, there would be an opportunity for tribal representatives to be present during data recovery. Additional knowledge of local and regional prehistory, including ancestral use of the study area, would be obtained through implementation of data recovery. Information collected during the recovery process would be added to the regional archaeological database.

Effects to Springs, Streams, and Seeps

The depth to groundwater beneath the study area is controlled by dewatering at the Barrick Goldstrike Mines Inc. (BGMI) facility. Mine dewatering activities at BGMI have lowered the groundwater levels approximately 1,700 feet beneath the project site. As a result, mine dewatering would not be required for the proposed project accept as necessary to control localized perched groundwater that may be encountered in the highwall during open-pit mining. The very limited dewatering activities for the proposed project are not expected to impact any perennial surface water sources.

There are 12 seeps located in areas that would be impacted by the proposed mine development. Potential impacts to these seeps are described in Section 3.4, Water Resources and Geochemistry. No perennial stream reaches or springs are located within the study area, and no impacts to perennial streams and springs would result from the proposed mine activities.

Illegal Collecting of Artifacts (Looting)

No illegal collecting of artifacts or looting would occur since all of the historic properties located within or adjacent to the study area have been or would undergo data recovery prior to project construction.

3.6.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. Under this alternative, five additional archaeological resources would be affected by expansion of the West WRDF. All five of the resources are prehistoric isolates, which by definition are not eligible for inclusion on the NRHP. Alternatively, four ineligible prehistoric lithic scatters located in the East WRDF would not be affected under this alternative. Other effects of this alternative on Native American traditional values would be the same as described for the Proposed Action.

3.6.2.3 Partial Pit Backfill Alternative

Potential impacts to Native American traditional values from the development of the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.6.2.4 No Action Alternative

The development of new facilities and implementation of the mining plan that comprise the proposed project would not occur under the No Action Alternative. The No Action Alternative would include completion of the closure and reclamation of the existing mine disturbance and reclamation of the surface exploration activities under the terms of the current permits and approvals. Data recovery currently recommended for 29 NRHP-eligible prehistoric sites located within proposed disturbance areas have been or would be completed.

3.6.3 Cumulative Impacts

The CESA for Native American traditional values is defined in Section 3.6.1, Affected Environment, and is shown in **Figure 3.6-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.6.3.1 Proposed Action

Project-specific issues identified by tribal representatives and analyzed for the proposed project include potential effects to archaeological sites, effects to springs, and illegal collection of artifacts. Cumulative effects to archaeological sites and springs, and cumulative effects associated with illegal collection of artifacts are described below.

Impacts to Archaeological Sites

As a result of previous cultural resource inventories conducted within the study area, 29 prehistoric sites eligible for the NRHP have been documented within or adjacent to proposed disturbance areas. Unavoidable adverse effects to 25 of the 29 sites have been mitigated through data recovery in accordance with the BLM and SHPO-approved HPTP. A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to SHPO for review. Although unavoidable adverse effects to these sites would be mitigated through data recovery, some of the data about the sites would be lost. Archaeological excavations of numerous sites currently are being conducted at many mines and other past, present, and RFFAs (e.g., utility and energy development) within the CESA; consequently, a substantial portion of the archaeological record will no longer be available for public interpretation or future investigations. Over time, this represents a cumulative effect - outcomes that are still present despite mitigation (treatment) of NRHP-eligible sites.

In addition, data recovery is not favored by some tribal representatives because the site ultimately would be destroyed. Therefore, within the context of Native American traditional values, it is anticipated that cumulative effects to NRHP-eligible sites as a result of mining and other human activity would continue as sites are excavated.

Effects to Springs, Streams, and Seeps

No incremental effects to surface water sources are anticipated as a result of the Proposed Action. Boulder Creek flows only in springtime, and the major source of flow is runoff. Under these circumstances and given the proposed project configuration, the proposed project would not contribute noticeable cumulative effects to Boulder Creek flows. No cumulative effects to Antelope Creek/Rock Creek are anticipated since the proposed project would have minimal presence in those watersheds. No cumulative effect to springs would occur as a result of the proposed project. Cumulative effects to seeps would result from the removal of 12 seeps within the PoO boundary. These impacts would add to the existing and future impacts on springs and seeps. Potential cumulative impacts to seeps and springs are discussed in Section 3.4, Water Resources and Geochemistry.

Illegal Collecting of Artifacts (Looting)

No illegal collecting of artifacts or looting would occur as a result of the Proposed Action because the NRHP-eligible sites located within or adjacent to proposed disturbance areas would undergo data recovery prior to project construction. Therefore, the Proposed Action would not cumulatively add to current levels of illegal collecting of artifacts and looting most likely occurring in the CESA.

3.6.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action.

3.6.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.6.3.4 No Action Alternative

Cumulative effects under the No Action Alternative would be the same as cumulative effects associated with the Proposed Action since data recovery for the 29 identified NRHP-eligible sites have been or would be completed.

3.6.4 Potential Monitoring and Mitigation Measures

The BLM acknowledges that certain impacts cannot be fully mitigated to the satisfaction of the tribes. As stated earlier in Section 3.6.2.1, Proposed Action, possible mitigation measures may lessen certain impacts. Adverse effects to religious, spiritual, or sacred values cannot be monitored or mitigated.

Unavoidable adverse effects to 25 NRHP-eligible sites located in or adjacent to the PoO boundary have been mitigated in accordance with the HPTP. A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to SHPO for review. Per the applicant-committed environmental protection measures, there would be an opportunity for tribal representatives to be present during data recovery. No additional monitoring or mitigation is recommended for Native American traditional values.

3.6.5 Residual Impacts

Unavoidable adverse effects to 25 NRHP-eligible prehistoric sites identified within or adjacent to the PoO boundary have been mitigated through data recovery in accordance with the BLM and SHPO-approved HPTP. A HPTP has been developed for the remaining four NRHP-eligible sites located along the Bootstrap Haul Road and submitted to SHPO for review. Although these sites have been or would be mitigated through implementation of data recovery, some of the cultural and traditional value associated with these sites cannot be fully mitigated; therefore, it is anticipated that residual impacts would occur to these resources.

3.7 Hazardous Materials and Solid Waste

3.7.1 Affected Environment

The study area for hazardous materials and solid waste includes the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occurs outside of the project PoO boundary; and the transportation route for hazardous materials and solid waste linked with Interstate 80 (I-80) including the Boulder Valley Road and Rodeo Flat Road (Elko County Road 237A) (**Figure 3.7-1**). The Cumulative Effects Study Area (CESA) for hazardous materials and solid waste encompasses the study area and mine activities along the Carlin Trend north of I-80 (**Figure 3.7-1**). The CESA chosen provides an adequate area of analysis in which to compare the relative effects of the Proposed Action to overall mining activity in the Carlin Trend.

The affected environment for hazardous materials includes air, water, soil, and biological resources. These resources potentially could be affected by an accidental release of hazardous materials during transportation to and from the study area and during storage and use within the study area.

3.7.1.1 Project-related Hazardous Materials

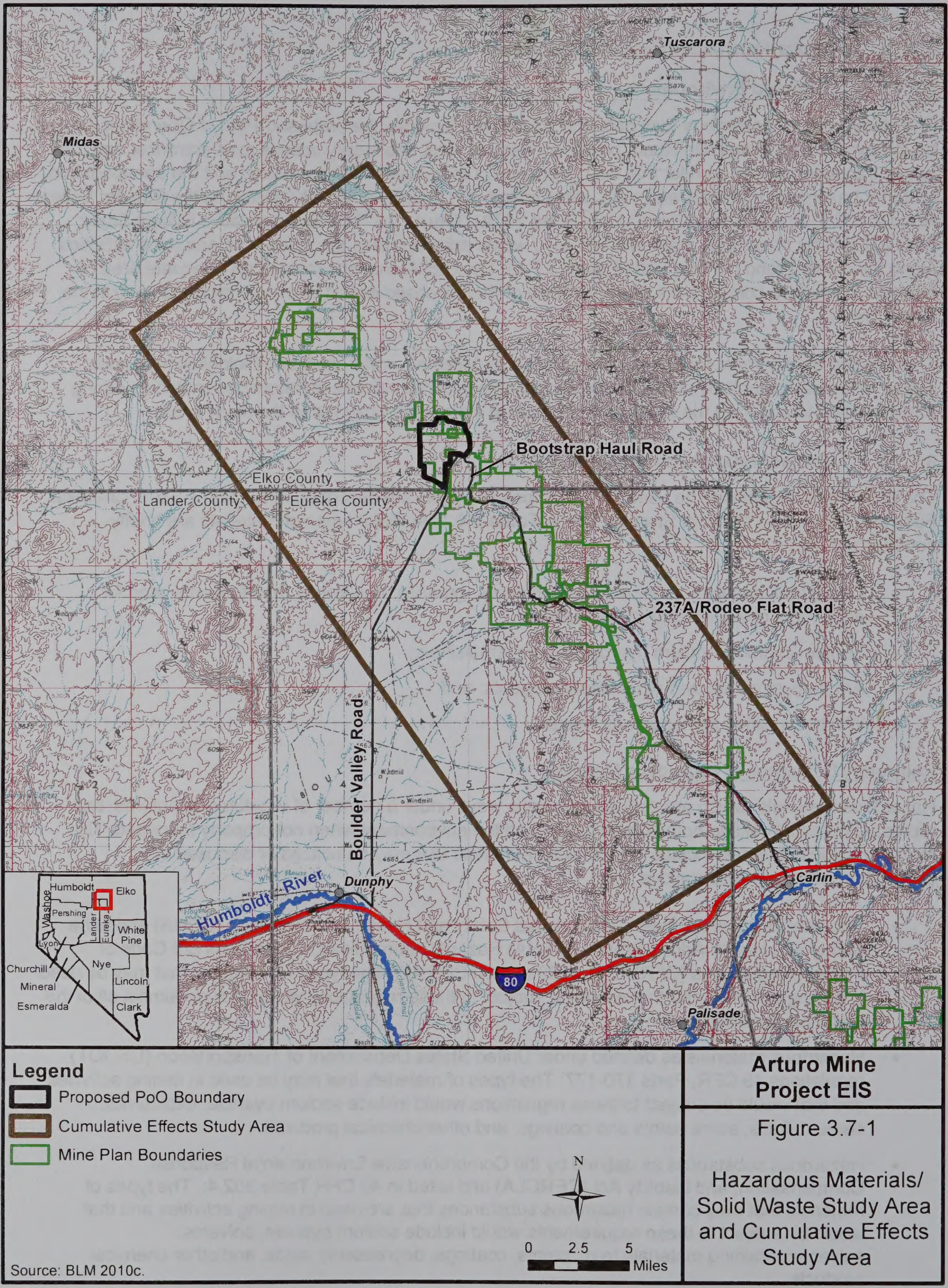
The hazardous materials to be used for the proposed project are described in Section 2.3.6.7, Chemical, Fuel, and Hazardous Material Storage, and in **Table 2-9**. The major types of materials are briefly summarized below:

- Diesel fuel, gasoline, propane, lubrication oils, greases, anti-freeze, and solvents used for equipment operation and maintenance;
- Sodium cyanide, sodium hydroxide, lime, emulsifiers;
- Ammonium nitrate and other blasting agents; and
- Waste classified as hazardous waste.

Regulatory Definitions of Hazardous Materials

Hazardous materials, which are defined in various ways under a number of regulatory programs, can represent potential risks to both human health and the environment when not properly managed. The term hazardous materials include the following materials that may be utilized or disposed of in conjunction with mining operations:

- Substances covered under Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) Hazard Communication Standards (29 Code of Federal Regulations [CFR] 1910.1200 and 30 CFR 42): The types of materials that may be used in mining activities and that would be subject to these regulations would include almost all of the materials identified above.
- Hazardous materials as defined under United States Department of Transportation (USDOT) regulations 49 CFR, Parts 170-177: The types of materials that may be used in mining activities and that would be subject to these regulations would include sodium cyanide, explosives, cement, fuels, some paints and coatings, and other chemical products.
- Hazardous substances as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR Table 302.4: The types of materials that may contain hazardous substances that are used in mining activities and that would be subject to these requirements would include sodium cyanide; solvents; solvent-containing materials (e.g., paints, coatings, degreasers); acids; and other chemical products.



Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.7-1

Hazardous Materials/ Solid Waste Study Area and Cumulative Effects Study Area

05/23/2012

- Hazardous waste as defined in the Resource Conservation Recovery Act (RCRA): Procedures in 40 CFR 262 are used to determine whether a waste is a hazardous waste. The types of materials used in mining activities and that may be subject to these requirements could include liquid waste materials with a flash point of less than 140 degrees Fahrenheit, spent solvent containing waste, corrosive liquids, and lab assay waste. Hazardous waste is regulated under Subtitle C of the RCRA. Any hazardous substances and extremely hazardous substances as well as petroleum products such as gasoline, diesel, or propane, that are subject to reporting requirements if volumes on hand exceed threshold planning quantities under Sections 311 and 312 of Superfund Amendments and Reauthorization Act (SARA): the types of materials that may be used in mining activities and that may be subject to these requirements would include fuels, coolants, acids, and solvent-containing products such as paints and coatings.
- Petroleum products defined as “oil” in the Oil Pollution Act of 1990: The types of materials used in mining activities and that would be subject to these requirements include fuels, lubricants, hydraulic oil, and transmission fluids.

In conjunction with the definitions noted above, the following lists provide information regarding management requirements during transportation, storage, and use of particular hazardous chemicals, substances, or materials:

- The SARA Title III List of Lists or the Consolidated List of Chemicals Subject to Emergency Planning and Community Right-to-Know Act and Section 112(r) of the Clean Air Act; and
- The USDOT listing of hazardous materials in 49 CFR 172.101.

Certain types of materials, while they may contain potentially hazardous constituents, are specifically exempt from regulation as hazardous waste. Used oil, for example, may contain toxic metals, but would not be considered a hazardous waste unless it meets certain criteria. Other waste that might otherwise be classified as hazardous are managed as “universal waste” and are exempted from hazardous waste regulations as long as they are handled in ways specifically defined by regulation. An example of a material that could be managed as a universal waste is lead-acid batteries. As long as lead-acid batteries are recycled appropriately, requirements for hazardous waste do not apply.

Pursuant to regulations promulgated under CERCLA, as amended by SARA, release of a reportable quantity of a hazardous substance to the environment must be reported within 24 hours to the National Response Center (40 CFR Part 302). The Nevada Administrative Code (NAC) (445A.347) also requires immediate reporting of a release of a reportable quantity of a hazardous substance to the Nevada Division of Environmental Protection (NDEP)-Bureau of Corrective Actions. In addition, under the State of Nevada Water Pollution Control Permit program, all releases of a reportable quantity must be reported as soon as possible, but not later than 24 hours after the event, to the NDEP-Bureau of Corrective Actions; and a spill report will be provided to NDEP. Nevada regulates the storage and handling of certain defined “highly hazardous substances” under NAC 459.952-459.9542. The Nevada State Fire Marshal requires that storage of hazardous materials above certain specified thresholds obtain a permit under NAC 459.9918 (Nevada State Fire Marshal and State Emergency Response Commission 2008).

Regulatory Definition of Solid Waste

Solid waste consists of a broad range of materials that include garbage, refuse, wastewater treatment plant sludge, non-hazardous industrial waste, and other materials (solid, liquid, or contained gaseous substances) resulting from industrial, commercial, mining, agricultural, and community activities (U.S. Environmental Protection Agency [USEPA] 2006). Solid waste is regulated under different subtitles of the RCRA and include hazardous waste (discussed in the previous section) and non-hazardous waste. Non-hazardous waste is regulated under RCRA Subtitle D. In Nevada, solid waste rules are found in the NAC. Disposal of solid waste is regulated under NAC 444.570-444.7499; disposal of hazardous waste is regulated under NAC 444.850-444.8746.

Solid Waste Generated from Mining Operations

The solid waste for the proposed project would include hazardous waste, universal waste, used products, solid non-hazardous waste, and sanitary waste. The waste types and volumes are described in **Table 3.7-1**.

Table 3.7-1 Waste Generated and Estimated Annual Quantities

Type of Waste	Estimated Annual Quantity
Hazardous Waste	
Drainage from punctured aerosol cans	110 gallons
Spent solvent	2,000 gallons
Used paint	220 gallons
Universal Waste	
Fluorescent bulbs	40
Vehicle batteries	50
Used Products	
Petroleum oil	40,000 gallons
Antifreeze	24,000 gallons
Solid Non-hazardous Waste	Variable

Source: Barrick Dee Mining Venture (BDMV) 2010c.

The facility would generate hazardous waste in amounts to be considered a Small Quantity Generator under the RCRA waste generator rules (USEPA 2006). Most of the hazardous waste would consist of spent solvent and used paint. Other waste consists of universal waste, used products (used oil and antifreeze), and solid non-hazardous materials.

Appropriate materials (used oil, batteries, and antifreeze) would be recycled. Solid non-hazardous materials (for example, construction debris and trash) would be disposed at an on-site Class III waivered mine site landfill located on public land in the East Waste Rock Disposal Facility (WRDF) (**Figure 2-2**). Sanitary waste would be managed by a septic system.

3.7.2 Environmental Consequences

The primary issues related to hazardous materials and solid waste include the potential for an accidental release of hazardous materials during transport to the project area or a release related to use or storage at the mine site.

3.7.2.1 Proposed Action

Under the proposed project, the transport, storage, use, and disposal of hazardous materials for mine operations would occur for 8 years. The type and frequency of hazardous material shipments would not be expected to change from the amounts provided in **Table 2-9**. If some of the chemicals identified for use during the life of the proposed project were to enter the environment in an uncontrolled manner, there could be associated direct impacts (a spill directly affecting soil or water) or indirect effects (movement of contaminants over time through impacted media). The environmental effects of a release would depend on the substance, quantity, timing, and location of the release. The event potentially could range from a minor oil spill on the project site where cleanup equipment would be readily available, to a severe release of sodium cyanide solution.

Transportation

All hazardous substances would be transported by commercial carriers or vendors in accordance with the requirements of Title 49 of the CFR. Carriers would be licensed and inspected as required by Nevada Department of Transportation and USDOT. Tanker trucks would be inspected and would have a Certificate of Compliance issued by the Nevada Motor Vehicle Division. These permits, licenses, and certificates are the responsibility of the carrier. Title 49 of the CFR requires that all shipments of hazardous substances be properly identified and placarded. Shipping papers must be accessible and must include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

A large-scale release of fuel or reagents would have implications for public health and safety. The location of the release would again be the primary factor in determining its importance. A release in a populated area could have effects ranging from simple inconvenience during cleanup to potential loss of life if an explosion and fire were involved. However, the probability of a release anywhere along a transportation route is very small; the probability of a release within a populated area is smaller; and the probability of a release involving an injury or fatality is smaller still. For the state of Nevada, the total number of crashes involving large trucks placarded for hazardous materials during the 2005 to 2008 period was 19 out of total of 2,428 crashes (USDOT 2010a). In the same time period, two incidents occurred in Elko County and two in Eureka County (USDOT 2010b). The national accident rate in 1996 for all categories of hazardous materials was 0.32 per million miles (Battelle 2001).

Storage and Use

BDMV has developed a Spill Contingency Plan that describes spill prevention measures, spill response, containment, and reporting procedures for hazardous materials to be stored and used on-site including sodium hydroxide, sodium cyanide, lime (calcium oxide), ammonium nitrate, petroleum fuels, bulk oils, and ethylene glycol (anti-freeze) (SRK 2009a). Operations conducted in accordance with the Spill Contingency Plan would ensure that impacts from spills would be minimized and the spilled materials contained and removed. BDMV would have the necessary spill containment and cleanup equipment available at the site, and personnel would be able to respond quickly.

All hazardous substances would be handled in accordance with applicable MSHA regulations (Title 30 CFR). The hazardous materials to be used under the proposed project would be handled as recommended on the manufacturer's Material Safety Data Sheets. Based on the facility's design features and the operational practices in place, the probability of a major release occurring at the site during the life of the proposed mine expansion would be low.

Disposal

All hazardous waste generated at the mine (including any liquid lab waste that meet the hazardous waste criteria) would be accumulated and transported to licensed disposal facilities in accordance with applicable federal and state regulations.

Potential Effects of a Release

The environmental effects of a release would depend on the material released, the quantity released, and the location of the release. Potential releases could include a small amount of diesel fuel spilled during transfer operations at the mine site or the loss of several thousand gallons of sodium hydroxide, diesel fuel, or sodium cyanide into a riparian drainage. In general, the materials of greatest concern would be sodium cyanide, sodium hydroxide, and diesel fuel.

The release of a hazardous material or waste into a sensitive area (such as stream, wetland, or populated area) is considered to be very unlikely. Depending on the material released, the amount released, and the location of the release, an accident resulting in a release could affect soils, water, biological resources, and human health.

Response to a Release

All spills, including transportation and loading/unloading spills occurring on site, would be cleaned up as soon as possible. If a spill exceeds reportable quantities, it would be reported to the NDEP-Bureau of Corrective Actions, NDEP-Bureau of Mining Regulation and Reclamation, USEPA, National Response Center, Bureau of Land Management (BLM), and the Eureka or Elko County Emergency Response Coordinator; and a spill report would be provided to NDEP.

In the event of a release en-route to the mine site, the transportation company would be responsible for response and cleanup. Law enforcement and fire protection agencies also may be involved to initially secure the site and protect public safety. Hazardous materials transporters are required to maintain an emergency response plan which details the appropriate response, treatment, and cleanup for a material spilled onto land or into water. For example, a release of hydrochloric acid could require neutralizing the spill with lime, flushing the area with water, or removing contaminated soil. Specific procedures would be developed for fuels, acids, and other hazardous materials. Any cleanup would be followed by appropriate restoration of the disturbed area, which could include replacing removed soil, seeding the area to prevent erosion, and the return of the land to its previous use.

3.7.2.2 Single Waste Rock Disposal Facility Alternative

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres (**Table 2-13**). Overall, this alternative would result in approximately 128 fewer acres of disturbance. Implementation of this alternative would result in an increase in fuel consumption compared to the Proposed Action as discussed in Section 3.22, Energy Requirements and Climate Change. All other direct and indirect impacts associated with this alternative would be the same as described for the Proposed Action.

3.7.2.3 Partial Pit Backfill Alternative

Under the Partial Pit Back Fill Alternative, there would be no change in footprint compared to the Proposed Action. However, waste rock backfilling would add an additional 1 year to the life of the project. The additional operational life of the project would increase time that fuel and other hazardous materials would be transported and used at the mine, but would result in a slight change in fuel use as compared to the Proposed Action. All other direct and indirect impacts and risks associated with the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.7.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the potential for release of hazardous materials as a result of the proposed project would not occur. Although activities for the Storm Underground Mine would continue to occur, the transportation and consumption of hazardous materials and generation of solid waste would be considerably reduced in comparison to the proposed project and would cease when operations were completed.

3.7.3 Cumulative Impacts

The CESA for hazardous materials and solid waste is defined in Section 3.7.1, Affected Environment, and is shown in **Figure 3.7-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.7.3.1 Proposed Action

The proposed project would contribute to an increase in the use of hazardous materials and generation of solid waste, which would be offset by the closure of mines in the area. For comparison purposes, the amount of fuel that would be used annually by the Proposed Action would be 15,000,000 gallons (**Table 2-9**). The current annual fuel consumption for the Carlin Trend was estimated to be 62,000,000 gallons (BLM 2010a). The Proposed Action would represent a 24 percent increase in fuel consumption in the Carlin Trend. As with the No Action Alternative, there is a very low probability for potential impacts and consequently no cumulative impacts.

3.7.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action.

3.7.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be similar to cumulative effects associated with the Proposed Action.

3.7.3.4 No Action Alternative

Quantities of hazardous materials transported and used and solid waste generated in the CESA are not expected to change appreciably in the future other than slight incremental increases (BLM 2008b). Quantities would be expected to decrease over the long term assuming the mineral deposits become depleted and no new major mining occurs. Based on the foregoing and the fact that the likelihood of potential impacts is very remote, there would be no cumulative impacts.

3.7.4 Potential Monitoring and Mitigation Measures

No additional monitoring or mitigation measures are recommended for hazardous materials and solid waste.

3.7.5 Residual Impacts

Residual impacts from the use of hazardous materials under the proposed project would depend on the substance, quantity, timing, location, and response involved in the event of an accidental spill or release. Operation in accordance with the facility's Spill Contingency Plan and prompt cleanup of potential spills and releases would minimize the potential of residual impacts due to accidental spills or releases of hazardous materials. Reagents such as sodium cyanide can be acutely toxic, but they do not persist in the environment for long periods of time. Modern regulations that govern the transportation, storage, use, and disposal of hazardous materials have greatly reduced the potential for residual impacts due to hazardous materials.

3.8 Air Quality

3.8.1 Affected Environment

The proposed project is located entirely in the upper reaches of the tributary Boulder Flat drainage (Hydrographic Basin 61), as delineated by the Nevada Division of Water Resources. The study area for air quality encompasses the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occurs outside of the proposed PoO boundary; and an area within 6 miles of the proposed project. The Cumulative Effects Study Area (CESA) for air quality encompasses the study area and mine activities along the Carlin Trend north of Interstate 80. **Figure 3.8-1** illustrates the CESA for air quality. The CESA includes the air basins adjacent to Hydrographic Basin 61 with mining activities, including portions of Rock Creek Valley and Willow Creek. Nevada is characterized by a series of mountain ranges separated by broad valleys. The eastern part of the state has an average elevation ranging from 5,000 and 6,000 feet above mean sea level (amsl). Nevada has several mountain ranges, most of them 50 to 100 miles long, generally running north-south. Nevada has considerable climatic diversity, ranging from scorching lowland desert in the south to cool mountain forests in the north. Its varied and rugged topography, mountain ranges, and narrow valleys range in elevation from approximately 1,500 to more than 10,000 feet amsl. Large local variations of temperature and rainfall are common. The principal climatic features are bright sunshine; low annual precipitation (averaging less than 9 inches in the valleys and deserts); heavy snowfall in the higher mountains; clean, dry air; and large daily ranges of temperature.

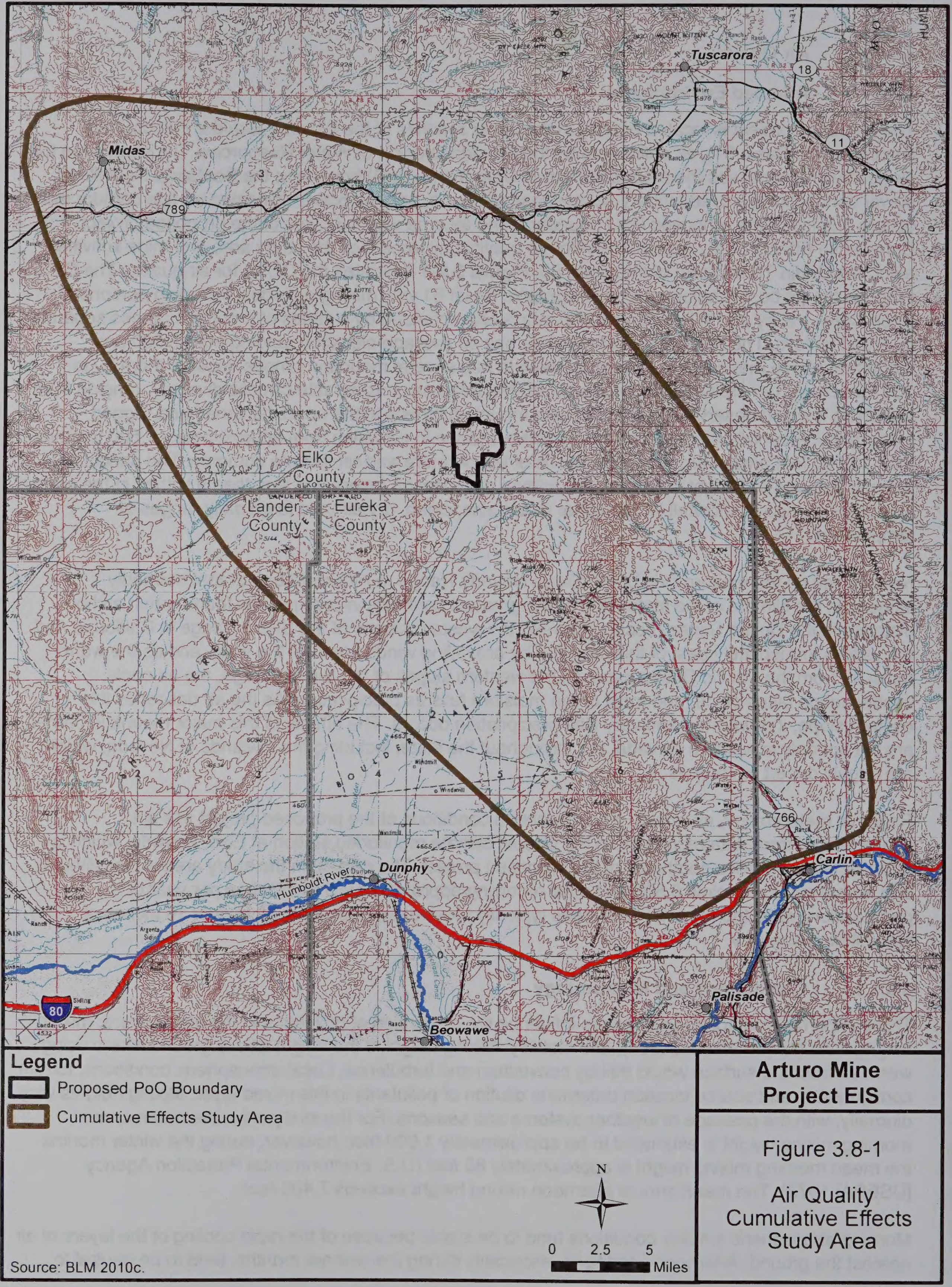
Nevada lies on the eastern side of the Sierra Nevada Range, a mountain barrier that markedly influences the climate of the state. One of the greatest contrasts in precipitation found within a short distance in the United States (occurs between the western slopes of the Sierra Range in California and the valleys immediately east of this range). The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascends the western slopes of the Sierra Range, the air cools, condensation takes place, and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed and very little precipitation occurs. The effects of this major mountain barrier are felt not only in western Nevada, but throughout the state, including the lowlands of Nevada, which are largely desert or steppes.

Regional meteorology, air quality, and dispersion conditions at the proposed project site are characterized from data records from the closest climate monitoring station at Elko, Nevada, which is approximately 40 miles southeast of the proposed project. The climate in the study area is classified as arid, with elevations below 6,500 feet amsl receiving approximately 5 to 9 inches per year of precipitation, while the mountainous areas typically receive approximately 11 to over 16 inches of precipitation annually.

3.8.1.1 Climatology and Meteorology

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, wind (speed and direction), and stability. Mixing height is the height above ground where rising warm air from the surface would mix by convection and turbulence. Local atmospheric conditions, terrain configuration, and source location determine dilution of pollutants in this mixed layer. Mixing heights vary diurnally, with the passage of weather systems and seasons. For the study area, the mean annual morning mixing height is estimated to be approximately 1,000 feet; however, during the winter months the mean morning mixing height is approximately 80 feet (U.S. Environmental Protection Agency [USEPA] 1972). The mean annual afternoon mixing height exceeds 7,400 feet.

Morning atmospheric stability conditions tend to be stable because of the rapid cooling of the layers of air nearest the ground. Afternoon conditions, especially during the warmer months, tend to be neutral to



Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.8-1

Air Quality Cumulative Effects Study Area

05/16/2012

unstable because of the rapid heating of the surface under clear skies. During the winter, periods of stable afternoon conditions may persist for several days in the absence of synoptic (i.e., continental scale) storm systems to generate higher winds with more turbulence and mixing. A high frequency of inversions at lower elevations during the winter can be attributed to the nighttime cooling and sinking air flowing from higher elevations to the low lying areas in the basins. Although winter inversions are generally quite shallow, they tend to be more stable because of reduced surface heating.

The proposed project is located at a latitude that places it within the belt of prevailing westerly winds that circle the globe around the earth's northern hemisphere. However, the proposed project is located in complex terrain where the winds are affected by local topographic features.

Due to the typically dry atmosphere, bright sunny days and clear nights frequently occur. This in turn allows rapid heating of the ground surface during daylight hours and rapid cooling at night. Because heated air rises, and cooled air sinks, winds tend to blow uphill during the daytime and down slope at night. The complexity of terrain features causes complex movements in the cyclic air patterns, with thin layers of moving air embedded within the larger scale movements. The lower level, thermally driven winds also are embedded within larger scale upper wind systems (synoptic winds). Synoptic winds in the region are predominantly west to east, are characterized by daily weather variations that enhance or diminish the boundary layer winds, and are channeled by regional and local topography.

The wind rose for Elko (**Figure 3.8-2**) is representative of the regional wind climatology. The Elko wind rose indicates that winds are predominantly from the west to southwest, but it also shows that there is a secondary maximum of wind occurrences from the northeast. Wind speed has an important effect on area ventilation and the dilution of pollutant concentrations from individual sources. Light winds, in conjunction with large source emissions, may lead to an accumulation of pollutants that can stagnate or move slowly to downwind areas. During stable conditions, downwind usually means down valley or toward lower elevations. Climate data from Elko indicate that the potential for air pollution episodes to last 5 or more days is nearly zero (USEPA 1972). A potential air pollution episode is defined as a period of time with wind speeds less than 2 meters per second and mixing heights less than 3,280 feet.

Table 3.8-1 shows the monthly climate summary data for temperature and precipitation for Elko during the 121-year period from January 1888 through July 2010. Summers are typically hot and dry. Precipitation falls throughout the year with much of it occurring as snowfall during the winter. The average annual precipitation at Elko is approximately 9.6 inches.

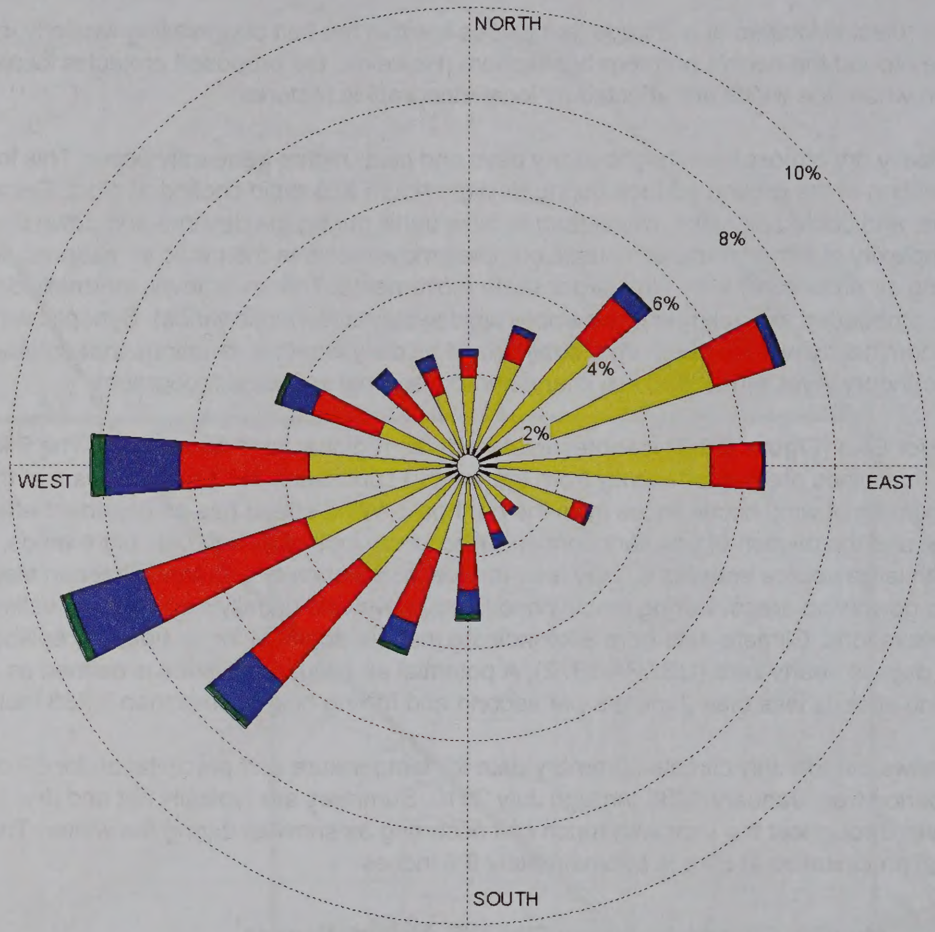
Table 3.8-1 Monthly Climate Summary Elko WB Airport, Nevada[1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (°F)	36.7	42.4	51.0	60.0	69.5	80.0	91.1	88.8	78.8	65.8	50.3	38.9	62.8
Average Min. Temperature (°F)	10.8	17.4	23.7	29.1	35.7	42.3	48.2	45.7	36.7	28.0	20.4	13.1	29.2
Average Total Precipitation (inches)	1.18	0.93	0.91	0.84	0.97	0.78	0.37	0.40	0.45	0.71	0.92	1.09	9.57
Average Total Snowfall (inch)	7.9	4.6	3.7	1.6	0.5	0.0	0.0	0.0	0.0	0.5	3.1	6.4	28.4
Average Snow Depth (inches)	2	1	0	0	0	0	0	0	0	0	0	1	0

[1] Period of Record: January 1, 1888 to July 31, 2010.
°F - degrees Fahrenheit.

Source: Western Regional Climate Center 2010.

Station # 24121 - Elko Municipal Airport, Nevada



Legend

Wind Speed (m/s)

🟦 > = 11.1
🟩 8.8 - 11.1
🟦 5.7 - 8.8
🟥 3.6 - 5.7
🟨 2.1 - 3.6
⬛ 0.5 - 2.1
Calms: 26 - 56%

Data Period: 1988 - 1992, Jan 1 - Dec 31, 00:00 - 23:00
5-Year Composite Wind Rose
Plot for Elko, NV
Total Count: 43,824 Hours
Calm Winds: 25.56%
Avg Wind Speed: 2.58 m/s

Arturo Mine Project EIS

Figure 3.8-2

5-Year Composite Wind Rose Plot for Elko, Nevada

Source: USEPA 2012.

05/24/12

The on-site data from the Arturo Mine meteorology station is in close agreement with the long-term record at Elko. Arturo maximum temperatures and precipitation are very similar to Elko records. Average minimum temperatures at the mine are somewhat higher than at the Elko site. **Table 3.8-2** shows precipitation data from the Arturo station for the period January 2002 through December 2004.

Table 3.8-2 Arturo Mine Precipitation Data 2002 - 2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002 Total Precipitation (inches)	0.87	0.95	1.09	0.70	1.81	0.67	0.16	0.10	0.28	0.13	1.50	1.20	9.46
2003 Total Precipitation (inches)	1.77	0.61	0.50	3.16	2.22	0.07	0.00	1.68	0.46	0.24	1.35	1.14	13.20
2004 Total Precipitation (inches)	1.91	1.33	0.25	1.61	1.57	0.10	0.19	1.22	1.37	2.24	1.19	1.62	14.60

Source: Barrick Dee Mining Venture (BDMV) 2010d.

3.8.1.2 Local Air Quality

Air quality is defined by the concentration of various pollutants and their interactions in the atmosphere. Pollution effects on receptors have been used to establish a definition of air quality. Measurement of pollutants in the atmosphere is expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Both long-term climatic factors and short-term weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of exposure. Air quality standards specify acceptable upper limits of pollutant concentrations and duration of exposure. Air pollutant concentrations within the standards generally are not considered to be detrimental to public health and welfare.

The relative importance of pollutant concentrations can be determined by comparison with appropriate national and/or state Ambient Air Quality Standards (AAQS). National and state AAQS are presented in **Table 3.8-3**. An area is designated by the USEPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the National Ambient Air Quality Standards (AAQS). An area is not in attainment if violations of National AAQS for that pollutant occur. Areas where insufficient data are available to make an attainment status designation are listed as unclassifiable and are treated as being in attainment for regulatory purposes.

The existing air quality of the study area is typical of the largely undeveloped regions of the western United States. For the purposes of statewide regulatory planning, this area has been designated as in attainment (not exceeding National AAQS for criteria pollutants) or unclassified for all pollutants that have an AAQS. Current sources of air pollutants in the region include several precious metals mines that are sources for particulate matter (PM) with aerodynamic diameters (in micrometers) designated as particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) and particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

Table 3.8-3 National and State of Nevada Ambient Air Quality Standards

Pollutant	Nevada Standards		National Standards	
	Averaging Time	Concentration $(\mu g/m^3)$	Primary $(\mu g/m^3)$	Secondary $(\mu g/m^3)$
Ozone (O_3)	1-Hour	235	NA	NA
O_3	8-Hour	NA	157	157
Carbon Monoxide (CO)	1-Hour	40,500	40,500	40,500
CO less than 5,000 feet amsl	8-Hour	10,500	10,500	10,500
CO at or greater than 5,000 feet amsl	8-Hour	6,670		
Sulfur Dioxide (SO_2)	1-Hour	NA	196	None
SO_2	3-Hour	1,300	None	1,300
SO_2	24-Hour	365	365	None
SO_2	Annual Average	80	80	None
Nitrogen Dioxide (NO_2)	1-Hour	NA	188	None
NO_2	Annual Average	100	100	100
PM_{10}	24-Hour	150	150	150
PM_{10}	Annual Average	50	NA	NA
$PM_{2.5}$	24-Hour	NA	35	35
$PM_{2.5}$	Annual Average	NA	15	15
Lead (Pb)	Rolling 3-month Average	0.15	0.15	0.15
Pb	Quarterly Arithmetic Mean	1.5	1.5	1.5
Hydrogen Sulfide	1-Hour	112	--	--
Visibility	Observation	Insufficient amount to reduce the prevailing visibility to less than 30 miles when humidity is less than 70 percent.	--	--

Source: Nevada Administrative Code (NAC) 2012; USEPA 2010a.

Global Mercury

Mercury is a naturally occurring element in many soils, volcanic rocks, and marine and geothermal water sources. It assumes many forms and can be found naturally in the environment as free metallic mercury chemically combined with other elements in a number of soil or rock types, and in the form of methylmercury (CH_3Hg+) in plants and animals. Mercury generally is present in the atmosphere in one of three chemical forms: gaseous elemental mercury, reactive gaseous mercury, or particulate-bound mercury. Reactive gaseous mercury and particulate-bound mercury account for less than 2 percent of the total concentration in air, with elemental mercury accounting for more than 98 percent of the total (Fitzgerald et al. 1991).

Mercury emissions to the atmosphere come from both background and man-made or anthropogenic sources. Background sources of mercury include natural sources such as naturally enriched soils and volcanoes. There are both global and local anthropogenic sources of mercury. The fate of mercury emissions follows a progression from the emission source to transport, deposition, exposure, and potential human risks. From a single source such as a power plant or mine, a portion of the emissions are deposited locally near the source while the remaining portion of the mercury is dispersed regionally and globally.

Understanding mercury speciation is important in understanding the deposition and bioaccumulation of mercury in the environment. Gaseous mercury must be transformed to particulate or oxidized mercury in order to contribute substantially to mercury deposition and subsequent entry into waterbodies where further transformation to CH_3Hg+ can make the mercury available in the aquatic food chain (Porcella 1994). The final pathway to humans for mercury exposure is through the eating of fish with CH_3Hg+ stored in their flesh. Approximately 0.3 percent of the total mercury emitted from a point source is deposited in lakes and streams to form a CH_3Hg+ compound (Porcella 1994).

Gaseous mercury is a relatively non-reactive chemical form that is not very soluble in water. This form of mercury travels the farthest and can be transported on wind currents for months to years if not oxidized, providing an opportunity for global transport and dispersion. Concentrations of mercury in the air usually are low and of little direct concern. However, atmospheric mercury falls to earth through rain or snow and enters lakes, rivers, and estuaries. Once there, it can transform to its most toxic form, CH_3Hg+, and accumulate in fish and animal tissue.

Mercury accumulates most efficiently in aquatic species. Predatory species at the top of the aquatic food chain generally have higher mercury concentrations. Nearly all of the mercury that accumulates in fish tissue is CH_3Hg+. Inorganic mercury, which is less efficiently absorbed and more readily eliminated from the body than CH_3Hg+, does not tend to bio-accumulate.

Oxidized or reactive mercury has an average atmospheric residence time of days to weeks (less in the presence of precipitation or bromine compounds often present in saline waterbodies). It is not easily volatilized and is water-soluble. It is easily taken up in precipitation or adsorbed on small particles in the atmosphere and falls as wet or dry deposition. This form of mercury has a higher potential to enter the food chain and result in concerns related to fish and waterfowl consumption.

Particle-bound mercury has an average atmospheric residence time of hours to days (depending on the presence or absence of precipitation and the particle size). It has low volatility and is easily taken up in precipitation or adsorbed on small particles, falling out relatively close to the emission source in the presence of precipitation, or as dry deposition that may be transported for longer distances if associated with very small particle sizes. Particle-bound mercury is relatively stable and is not easily converted to CH_3Hg+ (USEPA 1997a).

Local Mercury

When bound in mineral forms that typically appear in ore (e.g., cinnabar), mercury is a stable compound that remains in solid form. Ore processing has the potential to liberate mercury from these stable minerals by dissolving it in process solutions. Because it has a boiling point of 675°F, mercury has the potential to volatilize into a gaseous form when subjected to thermal processes in a recovery and refining circuit.

Climate Change and Green House Gas Emissions

Certain gases, called "greenhouse gases" (GHGs) including carbon dioxide; methane; nitrogen oxide; water vapor; and several trace gas emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Climate change and GHGs are discussed in Section 3.22, Energy Requirements and Climate Change.

3.8.2 Environmental Consequences

The Proposed Action includes activities with the potential to generate air emissions. Proposed activities that would have a potential impact to air quality include:

- Expansion of the existing open pit;
- Construction of the Waste Rock Disposal Facilities (WRDFs);
- Development of the new heap leach pad facilities;
- Mining and processing ore;
- Transporting ore over the Bootstrap Haul Road; and
- Development of ancillary and support facilities.

3.8.2.1 Regulatory Framework and Associated Impacts

Ambient air quality and the emission of air pollutants are regulated under both federal and state of Nevada laws and regulations as discussed below.

Federal Clean Air Act

The Clean Air Act (CAA), and the subsequent Federal Clean Air Act Amendments of 1990 (CAAA), require the USEPA to identify NAAQS to protect public health and welfare. The CAA and the CAAA established NAAQS for seven pollutants, known as "criteria" pollutants. The criteria pollutants are O_3, NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, and Pb. The ambient standards set for these pollutants satisfy "criteria" specified in the CAA. A list of the criteria pollutants regulated under the CAA and their currently applicable NAAQS set by the USEPA are listed in **Table 3.8-3**.

In addition to the designations relative to conforming with the NAAQS, the CAA requires the USEPA to place selected areas within the United States into one of three classes, which are designed to limit the deterioration of air quality when it is "better than" the NAAQS. Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in national parks and wilderness areas of a given size, which were in existence prior to 1977, or those additional areas that have since been designated Class I under federal regulations (40 Code of Federal Regulations [CFR] 52.21). All remaining selected areas outside of the designated Class I boundaries were designated Class II areas, which allow a relatively greater deterioration of air quality, although still below NAAQS. No Class III areas have been designated.

Federal Prevention of Significant Deterioration (PSD) regulations limit the maximum allowable increase in ambient particulate matter in a Class I area resulting from a major or minor kind of stationary source to 4 $\mu g/m^3$ (annual geometric mean) and 8 $\mu g/m^3$ (24-hour average). Increases in some of the other criteria pollutants are similarly limited. Specific types of facilities (listed facilities) that emit, or have the potential to emit, 100 tons per year (tpy) or more of total PM, PM_{10}, or other criteria air pollutants, or any facility that emits, or has the potential to emit, 250 tpy or more of total PM, PM_{10}, or other criteria air pollutants, are considered major stationary sources. Major stationary sources or major modifications are required to notify federal land managers of Class I areas, which may be affected by the emissions from the source. The nearest Class I planning area to the study area is the Jarbidge Wilderness Area, located approximately 101 kilometers (63 miles) northeast of the project area.

The PSD increments are triggered for a planning area when a PSD application for a major source or modification affecting that planning area has been deemed complete by the regulatory authority (40 CFR 52.21[b][14]). The closest triggered planning area (Air Pollution Control Region 61L) is located in the lower portion of the Boulder Flat Area, located approximately 7 miles to the south of the proposed project. The planning area in which the proposed project would be located has not been triggered for any pollutant. New Source Performance Standards (NSPSs), also required under the CAA, are set by the USEPA for specific types of new or modified stationary sources.

NSPS set fixed emission limits for classes of sources. Certain project components used to process metallic minerals are subject to the NSPSs found in 40 CFR Part 60, Subpart LL (Standards of Performance for Metallic Mineral Processing Plants), Subpart IIII, and Subpart JJJJ, and Part 6.3, Subpart CCCCCC.

The Federal Operating Permit, or "Title V," is a facility-wide permitting program introduced by the CAA that requires facilities with the potential to emit more than 100 tpy of any regulated pollutant (excluding PM), 10 tpy of any single hazardous air pollutant (HAP), or 25 tpy or more of any combination of HAPs, to submit a Title V operating permit. The proposed project would be classified as a minor source and would not be subject to the Title V operating permit program.

The CAA directs the USEPA to delegate primary responsibility for air pollution control to state governments, which comply with certain minimum requirements. The State Implementation Plan (SIP) was originally the mechanism by which a state set emission limits and allocated pollution control responsibility to meet the NAAQS. The function of a SIP broadened after passage of the CAAA and now includes the implementation of specific technology-based emission standards, permitting of sources, collection of fees, coordination of air quality planning, and prevention of significant deterioration of air quality within regional planning areas and statewide. Section 176 of the CAA, as amended, requires that federal agencies must not engage in, approve, or support in any way any action that does not conform to a SIP for the purpose of attaining AAQS (USEPA 2004). The Proposed Action would be subject to permitting under the New Source Review permitting program pursuant to 40 CFR 93.153(d)(1).

The Council on Environmental Quality's (CEQ's) advice to federal agencies for the National Environmental Policy Act analyses on GHG emissions states that:

> "Specifically, if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon dioxide-equivalent GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public" (CEQ 2010).

Maximum Achievable Control Technology (MACT)

On December 16, 2010, USEPA Administrator, Lisa Jackson, issued the final mercury MACT rule, National Emission Standards for Hazardous Air Pollutants: Gold Mine Ore Processing and Production Area Source Category; and Addition to Source Category List for Standards. The rule would impose mercury emission limits and associated testing, recordkeeping, and reporting requirements on various emission units associated with gold mining operations that have been identified as having the potential for mercury emissions. Such emission units include roasters, autoclaves, carbon kilns, electrowinning and associated pregnant solution tanks, furnaces, and retorts. Because the Dee/Arturo Project does not include any of these types of emission units, it would not be subject to the mercury MACT rule.

Nevada State Air Quality Program

The Bureau of Air Pollution Control (BAPC) is the agency in the State of Nevada that has been delegated the responsibility for implementing a SIP (excluding Washoe and Clark counties, which have their own SIP). Included in the SIP are the State of Nevada air quality permit programs (NAC 445B.001 through 445B.3497, inclusive). The Nevada AAQS also are part of the SIP. The Nevada AAQS generally are similar to the NAAQS. In addition to establishing the Nevada AAQS, the BAPC is responsible for permit and enforcement activities throughout the State of Nevada.

The BAPC permitting program implements the Title V federal operating permit program, as well as the minor source permitting program for facilities that emit less than 100 tpy of all criteria pollutants and are not a major source of HAPs.

Nevada Senate Bill 422, passed in 2007, mandated a statewide GHG inventory (Nevada Revised Statute 445B.380) to begin in 2008 with updates every 4 years. The Nevada Division of Environmental Protection (NDEP) published a statewide GHG emission inventory that includes GHG projections from 1990 to 2020 (NDEP 2008a). The report shows that gross GHG emissions in Nevada mainly can be attributed to electrical generation and transport, which comprise more than 75 percent of sources of GHG emissions. Electrical generating power plants that produce electricity for sale, have an output capacity of 5 megawatts, or more, and produce GHGs also are required by 2007 legislation to report annual GHGs. The data are collected in the Climate Registry and would be used to assess global climate change.

Under its broad statutory authority to regulate air pollution, the NDEP BAPC also has implemented a mercury control program that applies to all emission units located at precious metals mines that use direct or indirect thermal energy and have the potential to emit mercury. This program is unique to the State of Nevada and is codified at NAC 445B.3611 to NAC 445B.3689. The program's goal is to ensure that all non-de minimis thermal emission units are controlled to provide the maximum degree of reduction of mercury emissions in accordance with factors enumerated in the rule. Because the Project does not include any thermal units that emit mercury, these requirements would not apply.

3.8.2.2 Proposed Action

Criteria Pollutant Emissions for PoO Area

Gaseous pollutant emissions associated with the Proposed Action would result from blasting, construction and mining equipment, and vehicle exhaust. These emissions would be minimized by proper equipment maintenance and operation. BDMV would obtain required air quality construction and operating permits from the Nevada BAPC.

Fugitive dust emissions would be generated by expansion of the pit, transportation of ore and waste rock material within the PoO, in-pit and perimeter haul roads and access roads, mining, crushing, heap leach pad processing, and stockpiling ore. Transportation of ore on the Bootstrap Haul Road to the Barrick Goldstrike Mines Inc. (BGMI) facility and BGMI processing would also generate fugitive dust emissions. Particulate emissions would be mitigated by minimization of drop heights during loading, dust and milling suppression, and procedures outlined in BDMVs Dust Control Plan.

Table 3.8-4 lists the annual emissions from area, point, and volume sources from the proposed Arturo Mine operations. Each type of source is described in detail in the emissions inventory as listed in the Arturo Air Quality Impact Analysis (Enviroscientists, Inc. 2011a,b). Emissions from area sources include drilling, blasting, bulldozing, loading ore and waste rock, and wind erosion. Point sources include emissions from stacks associated with generators and heaters, as well as individual stationary facilities such as crushers, stockpiles, silo loading and unloading. Volume sources include all emissions from vehicles on paved and unpaved roads as well as conveyors and radial stackers.

Dispersion Modeling Analysis for PoO Area

The AERMOD Model is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

Table 3.8-4 Annual Emissions from the Proposed Action for PoO Area

	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	Nitrogen Oxides (NO_X) (tpy)	SO_2 (tpy)	CO (tpy)
Area Sources[1]	415.4	60.6	851.1	39.3	641.6
Point Sources[2]	0.3	0.3	4.2	0.3	0.9
Volume Sources[3]	52.2	12.7	0.0	0.0	0.0

[1] Area sources include fugitive dust and mobile sources such as drilling, blasting, bulldozing, excavators, motor graders, haul roads, light plants, and wind erosion.

[2] Point sources are heaters, backup generator, crushers, lime silo loading, and stockpile discharge conveyor.

[3] Volume sources are screen feeders, loader transfer, conveyor transfers, and other sources of fugitive dust.

Source: Enviroscientists, Inc. 2011a.

There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain using United States Geological Survey (USGS) Digital Elevation Data.

AERMET is an auxiliary program for AERMOD used to generate model ready hourly surface and profile meteorological data files from airport or other local monitoring sites.

AERMOD requires preprocessing of the receptors (locations where concentrations of pollutants are determined) through the AERMAP subprogram. AERMAP evaluates local topography in the vicinity of each receptor and assigns additional attributes to each one that allows AERMOD to better calculate terrain effects.

Model Selection and Options

The AERMOD Model is the preferred model for use in estimating ambient air pollutant concentrations resulting from the emissions of sources such as those included in the Proposed Action and with terrain similar to that found within and adjacent to the study area (USEPA 2005). The AERMOD model used in this analysis (version 12060) includes the Plume Rise Model Enhancement downwash algorithms that are used to calculate plume downwash from stack emissions caused by wind flowing over and around nearby buildings. The dispersion modeling used the USEPA's regulatory default options for SO_2 and the Plume Volume Molar Ratio option for NO_2.

Surface meteorological data representative of the study area is a required input data set for AERMOD. The model utilized 2007 meteorological data from the BGMI facility meteorological station, which is located approximately 5 miles from the study area. Upper air and surface air data from the National Weather Service's Elko station (station KEKO-725825 – elevation 1,548.4 meters amsl) were used to process the data used in the analysis. Upper air and surface data were processed through AERMET to generate hourly surface and profile meteorological data files.

Receptors

Receptor elevations were electronically generated through AERMAP for the boundary and Cartesian receptor grids using the USGS Digital Elevation Model data for the Santa Renia Fields, Rodeo Creek Northeast and Northwest, and the Beaver Creek 7.5-minute series (topographic) map, 30-meter file.

Boundary receptors spaced at 25-meter intervals and coinciding with the facility's proposed boundary were used. Two Cartesian receptor grids were utilized. A coarse grid with 50-meter receptor spacing for a distance of approximately 3,500 meters out from the emission sources was used. A regional 200-meter receptor grid was created that extended another 2,000 meters outward from the proposed project, for a total distance of 5,500 meters. The second class of receptors consisted of receptor "grids," the size and spacing of which were designed to cover the entire study area and a larger area outside of the proposed study area that is potentially accessible to the public.

The fugitive and combustion emissions from haul road traffic included the different ore and waste rock routes within the study area. In order to model each of the roads effectively, some of the individual emission sources were modeled as part of the open pit or area model source, and others were modeled as part of the respective haul end-points (WRDFs, heap leach pad, or crushing stations). The roads modeled between haul road end-points were represented as volume sources along the roadway.

Model emission rates for each of the individual model sources were used to calculate ambient concentrations for each hour of the modeled time period. The dispersion modeling assumed an operational and facility configuration that simulated a realistic maximum operational scenario. In addition to the assumptions made to calculate the applicable emission rates (that the mine was in full production of 330,000 tons per day), the heap leach pad and WRDFs were assumed to be built to one-half of their full proposed heights, and the open pits were assumed to be at their full depth, which would result in the maximum potential emissions from the haul trucks.

Emissions from multiple sources from various elements located within the study area were combined for the modeling. For example, emissions from bulldozers and haul trucks operating in the open pit were added to the open pit haul road fugitive emissions to represent the total emissions from the open pit.

Open-pit characterization is typically used for modeling particulate emissions as area sources. For gaseous pollutants, the open pit was modeled as a volume source. Appropriate hourly emissions rates were used for each modeled time period to compare with NAAQS. A more detailed description of the dispersion modeling can be found in the modeling reports (Enviroscientists, Inc. 2012, 2011a).

Modeled Background Concentrations

Rural background values recommended by the BAPC were selected for PM_{10}. BAPC considers these values appropriate for remote mining facilities. The BAPC's practice for particulate analyses is to use measured concentrations from the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring stations, as representative background concentration for rural Nevada sites. The Great Basin National Park IMPROVE site located in White Pine County, Nevada, were the closest site for this analysis.

The BAPC does not have a $PM_{2.5}$ background concentration at this time. Similar to PM_{10}, data from the Great Basin National Park IMPROVE site located in White Pine County, Nevada, were utilized to derive an appropriate background concentration value for $PM_{2.5}$. The BAPC recommends assuming zero background for NO_2 and SO_2 for a rural site like the Project area.

For CO, the most representative data were evaluated. Barstow, California, was chosen for the CO background value. Barstow is located at the junction of two interstates and is a major railroad center. Monitored combustion emissions would be expected to be higher in Barstow than at the proposed project area.

Modeling Results

One separate model run was conducted for each pollutant averaging period. For short-term (1-hour, 3-hour, 8-hour, and 24-hour) averaging periods, the first highest modeling result represents a conservative assessment of air quality impacts compared to NAAQS. The results of the dispersion modeling for the Proposed Action are presented in **Table 3.8-5**. This table shows the highest modeled results at any point of public access for the pollutant-averaging time combinations for each pollutant and the applicable standard. Results show that for all pollutant-averaging time combinations, the Proposed Action modeled ambient concentrations for the Proposed Action with the addition of background concentrations are within the applicable ambient standards at any modeled point of public access.

Table 3.8-5 Highest Modeled Air Pollutant Concentrations from the Proposed Action for PoO Area

Pollutant Averaging	Period	Modeling Results (µg/m^3)	Background Value (µg/m^3)	Modeled Results Including Background[1,2] (µg/m^3)	Standard (µg/m^3)
PM_{10}	24-hour	120.36	10.20	130.56	150
PM_{10}	Annual	23.13	9.00	32.13	50
$PM_{2.5}$	24-hour	20.1	6.8	26.9	35
$PM_{2.5}$	Annual	4.22	2.38	6.60	15
SO_2	1-hour	11.98	0	11.98	196
SO_2	3-hour	192.1	0	192.1	1,300
SO_2	24-hour	18.0	0	18.0	365
SO_2	Annual	1.8	0	1.8	80
CO	1-hour	1,720	3,771	5,491	40,000
CO	8-hour	378	1,666	2,044	6,670
NO_2	1-hour	120.22	0	120.22	188
NO_2	Annual	44.38	0	44.38	100

[1] In March 2010, the USEPA issued a guidance memorandum (USEPA Guidance) on "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" (USEPA 2010b). The USEPA Guidance recommends that the modeled concentration be added to the monitored "design value." The 24-hour design value is defined as the 3-year average of the 98th percentile 24-hour average $PM_{2.5}$ concentration.

[2] Modeling was not performed for Pb and hydrogen sulfide since emissions of these pollutants from the project are considered to be negligible. Dispersion modeling was not performed for O_3 because O_3 is not emitted from proposed project sources.

Source: Enviroscientists, Inc. 2012, 2011a.

Criteria Pollutant Emissions for Hauling Ore to BGMI on the Bootstrap Haul Road

Haul truck emissions associated with off-site transport of ore from the proposed project to the BGMI facility via the Bootstrap Haul Raod were quantified. A maximum of 4.47 million tpy would be trucked off-site from the proposed project to BGMI. The emission inventory evaluates the emissions of regulated pollutants for the truck traffic on a round trip basis.

The total potential combustion and fugitive emissions along the Bootstrap Haul Road truck route were assessed. The round trip from the proposed project to the entry of the BGMI facility was modeled at 7 miles (approximately 3.5 miles each way). In the analysis, the hauling of 4.47 million tpy of material assumed an average of 27,948 round trips per year.

Combustion emission factors for $PM_{2.5}$, PM_{10}, NO_X, CO, and SO_2 were derived from the USEPA's MOBILE6 model. The potential fugitive emissions, which include PM_{10} and $PM_{2.5}$, for unpaved roads were calculated using USEPA AP-42 (USEPA 1995) Section 13.2.2, Unpaved Roads Emission

Calculation and Correction Parameters (11/06). The total estimated annual emissions for hauling ore off-site are presented in **Table 3.8-6**. The proposed project would begin in 2013 as shown in the schedule presented in **Figure 2-10**. Hauling of ore to BGMI is estimated to begin in 2013 and would continue for 7 years.

Table 3.8-6 Estimated Maximum Potential Annual Emissions from Ore Haulage to BGMI – Proposed Action

Source	Pollutant				
	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	CO (tpy)	NO_X (tpy)	SO_2 (tpy)
Fugitive Emissions	60	6	-	-	-
Combustion Emissions	2,120	1,750	6,320	4,960	2,400

Source: Enviroscientists, Inc. 2011a.

Criteria Pollutant Emissions for Processing Arturo Ore at BGMI

Ore from Arturo mine would be sent to BGMI for processing through roasters, autoclaves, or directly through the carbon-in-leach (CIL). Refractory ore from Arturo would be processed through either the roasters or the autoclaves to be oxidized prior to leaching. The non-refractory ore does not require pre-processing and would be sent directly to the CIL.

An estimate of emissions of criteria pollutants and HAPs attributed to processing Arturo ore at BGMI are based on the amount of Arturo ore processed compared to the total ore processed at BGMI. For example, in 2013, BGMI is projected to process a total of 4,982,000 tons of ore. The Arturo Mine would send BGMI about 31,400 tons of ore to be processed at BGMI in 2013. Arturo ore would account for about 0.6 percent of the total ore processed at BGMI for that year. Concentrations of the pollutants attributed to Arturo ore would be approximately 0.6 percent of the impacts from emissions at BGMI.

The percent emissions and resulting concentrations from processing Arturo ore at BGMI would vary from year to year based on the total ore processed and the percentage of ore that originated at Arturo. **Table 3.8-7** shows the estimated percent of the total BGMI impacts that can be attributed to Arturo ore for Years 1 through 7. The processing of Arturo ore is expected to contribute between 0.6 percent and 88.6 percent of the pollutant concentrations.

Table 3.8-7 Arturo Ore as a Percentage of Total Ore Processed at BGMI

Year	Total Ore Throughput (tpy)	Arturo Ore (tpy)	Arturo Ore Percentage (percent)
2013	4,981,560	31,382	0.6
2014	5,045,295	291,760	5.8
2015	5,123,179	2,901,948	56.6
2016	5,123,996	2,578,767	50.3
2017	5,098,703	1,135,114	22.3
2018	5,050,342	1,391,182	27.5
2019	5,047,101	4,471,578	88.6

Source: Air Sciences Inc. 2010a.

$PM_{2.5}$ emission inventories were developed for the processing of Arturo ore at BGMI using USEPA AP-42 (USEPA 1995) factors and site-specific operational data. Process emissions are presented for sources that process autoclave ore only (autoclave sources), sources that process roaster ore only (roaster sources), and downstream sources that process a combined ore stream, including the ore sent directly to the CIL. $PM_{2.5}$ emissions from processing Arturo ore at BGMI would range from 3.97 to 38.95 tpy. **Table 3.8-8** shows the annual $PM_{2.5}$ emissions in tons for each of the future mine years.

Table 3.8-8 $PM_{2.5}$ Emissions from Processing Arturo Ore at BGMI for Each Mine Year

	Arturo Ore Throughput (tons)			Arturo Ore $PM_{2.5}$ Emissions (tons)				
Year	Autoclave Sources	Roaster Sources	Downstream Sources	Autoclave Sources	Roaster Sources	Downstream Sources	Fugitive Sources	Total
2013	392	193	31,382	0.01	0.00	0.08	3.88	3.97
2014	16,756	8,253	291,760	0.32	0.12	0.77	3.88	5.09
2015	1,041,714	513,083	2,901,948	19.65	7.75	7.67	3.88	38.95
2016	299,192	147,363	2,578,767	5.64	2.22	6.82	3.88	18.57
2017	113,546	55,926	1,135,114	2.14	0.84	3.00	3.88	9.87
2018	156,911	77,284	1,391,182	2.96	1.17	3.68	3.88	11.69
2019	721,730	355,479	4,471,578	13.62	5.37	11.82	3.88	34.68

Source: Air Sciences Inc. 2010b.

Table 3.8-9 shows the total $PM_{2.5}$ emissions from all of the ore processed at BGMI compared to the $PM_{2.5}$ emissions from processing Arturo ore at BGMI for the future mine years. BGMI emissions would range from 112.64 to 115.86 tpy. The processing of Arturo ore would contribute between 3.5 and 33.6 percent of the total $PM_{2.5}$ emissions from BGMI.

Table 3.8-9 Annual $PM_{2.5}$ Emissions from Arturo Ore Processed at BGMI as a Percent of Total $PM_{2.5}$ Emissions at BGMI

Year	Total Throughput (tons)	Total $PM_{2.5}$ Emissions (tons)	Arturo $PM_{2.5}$ Emissions (tons)	Arturo (percent)
2013	4,981,560	112.64	3.97	3.5
2014	5,045,295	114.08	5.09	4.5
2015	5,123,179	115.84	38.95	33.6
2016	5,123,996	115.86	18.57	16.0
2017	5,098,703	115.29	9.87	8.6
2018	5,050,342	114.19	11.69	10.2
2019	5,047,101	114.12	34.68	30.4

Source: Air Sciences Inc. 2010b.

Proposed Project HAP Emissions

Annual project HAP emissions were estimated to determine if the proposed project would constitute a major HAP source. The inventory includes all stationary sources, as well as the process fugitive emissions from mining and processing operations for the open pit and heap leach area. The fugitive dust from trucking, dumping, and blasting also are included. HAP combustion emissions from mobile sources, such as haul vehicles, do not contribute to the HAP emission calculation for major source status but also are included in this analysis. The total estimated HAPs emissions are 0.32 tpy.

Internal combustion emissions primarily would be from diesel-fired generators. The external combustion emissions primarily would be derived from boilers and heaters. Standard USEPA-approved HAP emission factors were used for all three of these source types. Metallic HAP process fugitive emissions were calculated by totaling the annual particulate emissions and multiplying them by the average metal concentration in the mined material.

No individual HAP is emitted in a quantity greater than the major source limit of 10 tpy, and the combined HAP emissions are less than the major source limit of 25 tpy. Therefore, the Proposed Action would not constitute a major HAP source.

The Betze Pit Expansion Project Draft Supplemental Environmental Impact Statement (EIS) (Bureau of Land Management [BLM] 2008b) shows a HAPs emissions inventory of a total of 7.96 tpy of HAP emissions from processes at BGMI. Arturo ore would contribute approximately the same percentages of HAP emissions as shown in **Table 3.8-7** (Air Sciences Inc. 2010a).

Proposed Project Mercury Emissions

The BAPC also is responsible for the Mercury Control Program (MCP) implemented in March 2006. The MCP is designed to control mercury emissions from thermal units located at precious metal mines and mills. In the initial phase of the MCP, data on thermal units and their controls were collected throughout Nevada. This is being followed by the development of case-by-case Nevada Maximum Achievable Control Technology standards for each thermal unit.

The installation of Nevada Maximum Achievable Control Technology control devices, incorporation of work practice standards, establishment of reporting and recordkeeping, and a mercury emission limit is a requirement under the MCP. Mining facilities can request smaller emitting thermal units that would emit less than a facility-wide total of 5 pounds per year of mercury, to have a de minimis designation. Because the proposed project does not include any thermal units that emit mercury, these requirements would not apply.

The loaded carbon would be sold and sent to BGMI for additional processing. The maximum potential hourly emissions of mercury at BGMI would not increase due to the processing of Arturo ore, and there would be no projected increases in total annual mercury emissions from the facility.

Based on 2009 stack test results at the BGMI processing facility, the total annual mercury emissions from processing ore at BGMI are estimated to be 378 pounds per year. Similar to the analysis above, the mercury emissions from processing Arturo ore at BGMI can be estimated based on the amount of Arturo ore processed relative to the total ore processed at BGMI, after taking into account that Arturo ore on average has less mercury per ton than BGMI ore. The average mercury concentration of the Arturo ore to be processed at BGMI is 4.1 ppm, while the BGMI ore mercury concentration is 14.1 ppm. After applying this scaling factor of approximately 29 percent to the various thermal processes at BGMI, an estimate of Arturo's ore contribution to mercury emissions can be made for future mining Years 1 through 7. **Table 3.8-10** shows the annual mercury emissions in pounds per year for each of the future mine years.

Table 3.8-10 Estimated Ore Throughput by Process and Resultant Mercury Emissions from Processing Arturo Ore at BGMI

Year	Autoclave (tons)	Roaster (tons)	CIL (tons)	Total (tons)	Mercury Emission from Arturo Ore Processing at BGMI (pounds)
2013	392	193	30,797	31,382	0.0
2014	16,756	8,253	266,751	291,760	0.7
2015	1,041,714	513,083	1,347,151	2,901,948	25.3
2016	299,192	147,363	2,132,212	2,578,767	9.0
2017	113,546	55,926	965,642	1,135,114	3.6
2018	156,911	77,284	1,156,987	1,391,182	4.8
2019	721,730	355,479	3,394,369	4,471,578	20.1

Source: Air Sciences Inc. 2010c.

3.8.2.3 Single Waste Rock Disposal Facility Alternative

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. All other project facilities would be the same as the Proposed Action.

This Alternative was modeled in the same manner as the Proposed Action using the AERMOD Model which is the preferred model for use in estimating ambient air pollutant concentrations resulting from the emissions within the study area.

The fugitive and combustion emissions from haul road traffic included the different ore and waste rock haulage routes. In order to model each of the roads effectively, some of these individual emission sources were modeled as part of the open pit or area model source, and others were modeled as part of the respective haul end-points (waste rock storage areas, heap leach pad, or crushing stations). The roads modeled between haul road end-points were represented as volume sources along the roadway.

Model emission rates for each of the individual model sources were used to calculate ambient concentrations for each hour of the modeled time period. The dispersion modeling assumed an operational and facility configuration that simulated a realistic operational maximum scenario.

One separate model run was conducted for each pollutant averaging period. For short-term averaging periods, the first highest modeling result represents a conservative assessment of air quality impacts compared to NAAQS. The results of the dispersion modeling for the Single WRDF Alternative are presented in **Table 3.8-11**. This table shows the highest modeled results at any point of public access for all pollutant-averaging time combinations for each pollutant and the applicable standard for each of the pollutant-averaging time combinations. Results show that for all pollutant-averaging time combinations, the modeled ambient concentrations with the addition of background concentrations for the Single WRDF Alternative are within the applicable ambient standards at all points of public access.

Potential air quality impacts under this alternative would be similar to impacts under the Proposed Action.

Table 3.8-11 Highest Modeled Air Pollutant Concentrations from the Single WRDF Facility Alternative

Pollutant Averaging	Period	Modeling Results ($\mu g/m^3$)	Background Value ($\mu g/m^3$)	Modeled Results Including Background[1,2] ($\mu g/m^3$)	Standard ($\mu g/m^3$)
PM_{10}	24-Hour	125.06	10.20	135.26	150
PM_{10}	Annual	21.16	9.00	30.16	50
$PM_{2.5}$	24-Hour	20.71	6.80	27.51	35
$PM_{2.5}$	Annual	5.75	2.38	8.13	15
SO_2	3-Hour	54.86	28.6	83.46	1,300
SO_2	24-Hour	16.4	18.3	34.7	365
SO_2	Annual	0.5	5.3	5.8	80
CO	1-Hour	4,892	3,771	8,663	40,000
CO	8-Hour	1,112	1,666	2,778	10,000
NO_2	Annual	88.90	9.43	98.33	100

[1] In March 2010, the USEPA issued a guidance memorandum (USEPA Guidance) on “Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS” (USEPA 2010b). The USEPA Guidance recommends that the modeled concentration be added to the monitored “design value.” The 24-hour design value is defined as the 3-year average of the 98th percentile 24-hour average $PM_{2.5}$ concentration.

[2] Modeling was not performed for Pb and hydrogen sulfide since emissions of these pollutants from the project are considered to be negligible. Dispersion modeling was not performed for O_3 since O_3 is not emitted from project sources.

Source: Enviroscientists, Inc. 2011b.

3.8.2.4 Partial Pit Backfill Alternative

Impacts from the Partial Pit Backfill Alternative for criteria pollutants and GHG emissions would be somewhat less than impacts under the Proposed Action since there would be less distance to haul waste rock, thereby reducing fuel usage. Power purchased would be the same as the Proposed Action.

3.8.2.5 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the associated air quality impacts would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations.

3.8.3 Cumulative Impacts

The CESA for air quality is defined in Section 3.8.1, Affected Environment, and is shown in **Figure 3.8-1**. The past, present, and reasonably foreseeable future actions (RFFAs) in this area, are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.8.3.1 Proposed Action

Cumulative impacts to air quality would include impacts from the proposed project emission sources in combination with impacts from background emission sources, which reflect emissions associated with the past, present, and RFFAs.

The AERMOD model was used to conduct the cumulative air quality analysis. The Leeville Project, Final Supplemental EIS summarized emission sources considered in the cumulative air quality modeling analysis (BLM 2010b). A total of 338 emission sources were included in the model covering all emission sources in five facility groups. Emissions were organized into a series of emission source groups so that different combinations of source impacts could be evaluated separately. This information is presented in **Table 3.8-12**.

Table 3.8-12 Summary of Emission Sources Included in Air Quality Modeling

Facility	Number of Model Sources	Emissions of PM_{10} (tpy)	Emissions of CO (tpy)	Emissions of NO_X (tpy)	Emissions of SO_2 (tpy)
South Operations Area Project Amendment	84	568	337	354	276
Leeville	7	0.5	0	0	0
North Operations Area without Leeville	40	93.8	0	0	0
BGMI (Betze-Post)	179	579	400	311	996
TS Power Plant	28	598	744	1,170	1,546
Total	**338**	**1,839.3**	**1,481**	**1,835**	**2,818**

Source: BLM 2010b.

Consistent with direction from NDEP BAPC for regulatory modeling, a background 24-hour PM_{10} concentration of 10.2 $\mu g/m^3$, and an annual PM_{10} concentration of 9.0 $\mu g/m^3$, were added to the maximum modeled 24-hour concentration and the maximum modeled annual concentration, respectively, to account for background PM_{10} concentrations and to determine compliance with applicable Nevada AAQS.

The PM_{10}, SO_2, NO_2, and CO modeling predictions and monitoring data presented in the Leeville Project, Final Supplemental EIS (BLM 2010b) show the lack of cumulative air quality impacts. The cumulative analysis discussed in the Leeville Project, Final Supplemental EIS includes the Leeville and South Operations Area Project Amendment projects, BGMI operations, new TS Power Plant, and other sources of air emissions in the vicinity of the Carlin Trend. Ore throughput at BGMI would not increase due to Arturo ore processing; therefore, the results of previously analyzed cumulative impacts are applicable to the processing of Arturo ore at BGMI. Consequently cumulative impacts involving reasonably foreseeable projects would not result in exceedance of ambient air quality standards. Safeguards included in the NDEP permitting process would restrict air emissions such that cumulative effects to air quality from multiple sources would not violate ambient air quality standards.

Mercury Deposition

In the Betze Pit Expansion Project Draft Supplemental EIS (BLM 2008b), the analysis of mercury deposition from BGMI is based on the 2007 version of the USEPA Regional Modeling System for Aerosols and Deposition (REMSAD) modeling. The total mercury emissions modeled for BGMI in the

REMSAD modeling was 588 pounds per year, which was based on BGMI's 2006 mercury emissions. An estimate of the mercury deposition associated with processing Arturo ore at BGMI can be made by assuming that the deposition associated with processing Arturo ore at BGMI is directly proportional to the percentage of mercury emissions attributable to Arturo. The highest projected mercury emission from processing Arturo ore at BGMI is 25.3 pounds during mining Year 3 as shown in **Table 3.8-10**. This value is about 4.3 percent of the emissions used in the REMSAD modeling (588 pounds per year); therefore, the processing of Arturo ore at BGMI would account for about 4.3 percent of the total deposition attributed to mercury emissions modeled for BGMI.

The REMSAD modeled global background deposition results for this region of Nevada show that mercury deposition rates attributed to BGMI emissions represent about 1 percent of the global background. Processing Arturo ore at BGMI would then potentially result in about 0.043 percent of the global background (4.3 percent of 1 percent).

The Betze Pit Expansion Project Draft Supplemental EIS (BLM 2008b) also examined nearby waterbodies for mercury deposition caused by mercury emissions from BGMI. The REMSAD model results show that BGMI's contribution to the mercury deposition in the Willow Creek Reservoir region, approximately 32 kilometers northwest of BGMI, is approximately 10 percent of global background that includes TS Power Plant and other regional sources. Therefore, processing Arturo ore at BGMI would then potentially result in about 0.43 percent of the global background at Willow Creek Reservoir (4.3 percent of 10 percent) and 0.034 percent of the global background at Wildhorse Reservoir (4.3 percent of 0.8 percent).

3.8.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative impacts to air quality under the Single WRDF alternative would be similar to impacts under the Proposed Action.

3.8.3.3 Partial Pit Backfill Alternative

Cumulative impacts to air quality under the Partial Pit Backfill Alternative would be somewhat less than impacts under the Proposed Action since there would be less distance to haul waste rock, thereby reducing fuel usage.

3.8.3.4 No Action Alternative

There would be no cumulative air quality impacts under the No Action Alternative. Fugitive dust and gaseous emissions from existing mine operations currently affect air quality in the project area.

3.8.4 Potential Monitoring and Mitigation Measures

Air quality emission sources would be subject to requirements of federal and Nevada air quality regulations. NDEP Bureau of Air Quality would determine whether air quality construction and operating permits would be required for the Proposed Action. The air quality permitting process requires BDMV to submit a permit application, including a complete inventory of potential criteria air pollutant emissions from the Proposed Action. No additional monitoring or mitigation measures have been identified, as no substantive impacts to air quality would be anticipated as a result of the Proposed Action.

3.8.5 Residual Impacts

There would be no residual impacts to air quality from the Proposed Action or alternatives because reclamation and revegetation would stabilize exposed soil and control fugitive dust emissions. As vegetation becomes established, particulate levels should return to typical conditions of a dry desert environment. Once the disturbance ceases and wind erodible surfaces are reclaimed, the resource would return to approximately its pre-mining condition.

3.9 Paleontological Resources

3.9.1 Affected Environment

The study area for paleontological resources includes the proposed Plan of Operations (PoO) boundary; and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor, that occurs outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for paleontological resources is comprised of the study area and the mining activity area in the Carlin Trend north of Interstate 80 (**Figure 3.9-1**). The CESA chosen provides an adequate area of analysis in which to compare the relative effects of the proposed action to overall mining activity in the Carlin Trend.

3.9.1.1 Regulatory Structure

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law [P.L.] 59-209; 16 United States Code 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federally administered lands. Federal protection for scientifically important paleontological resources would apply to construction or other related project impacts that would occur on federally owned or managed lands. This act provides for funding for mitigation of paleontological resources discovered during federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization." In addition to the foregoing, the National Registry of Natural Landmarks provides protection to paleontological resources. The Bureau of Land Management (BLM) manages paleontological resources (fossils) on federal lands under the following statutes and regulations (BLM 2010d):

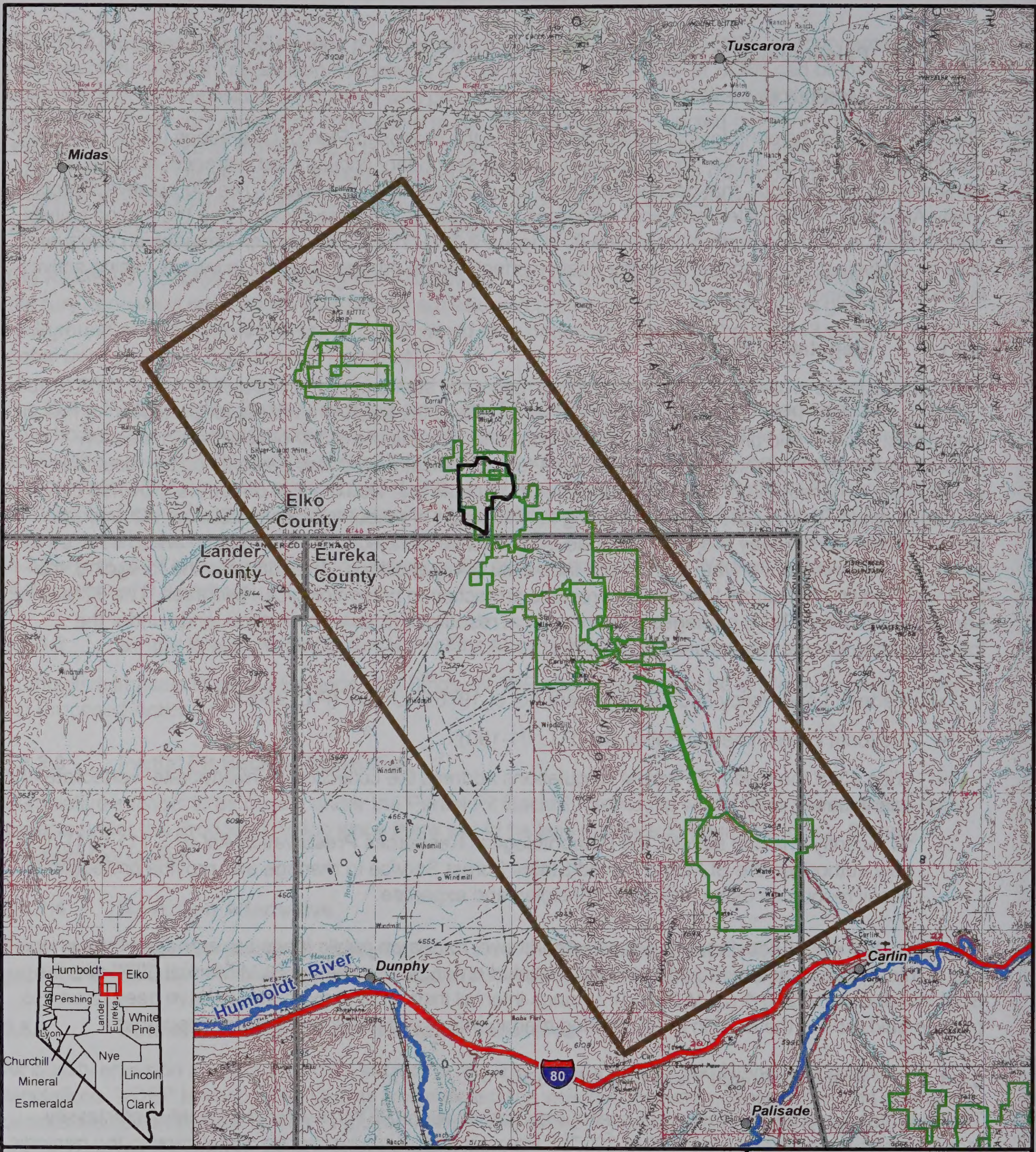
- Federal Land Policy and Management Act of 1976 (FLPMA) (P.L. 94-579);
- National Environmental Policy Act (P.L. 91-190);
- Title 43 of the Code of Federal Regulations address the collection of invertebrate, vertebrate and plant fossils; and
- A recently enacted statute, the Paleontological Resources Preservation Act (P.L.111-011). The law authorizes the BLM and United States Forest Service to manage and provide protection to fossil resources using "scientific principles and expertise."

In addition to the statutes and regulations listed above, fossils on public lands are managed through the use of internal BLM guidance and manuals. Included among these are the BLM Manual 8270 and the BLM Handbook H-8270-1 (BLM 2010d). Various internal instructional memoranda have been issued to provide guidance to the BLM in implementing management and protection to fossil resources.

3.9.1.2 Potential Fossil Yield Classification

The BLM has adopted the Potential Fossil Yield Classification (PFYC) system to identify and classify fossil resources on federal lands (BLM 2007c). Paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

The PFYC system is a way of classifying geologic units based on the relative abundance of vertebrate fossils or scientifically significant fossils (plants, vertebrates, and invertebrates) and their sensitivity to adverse impacts. A higher class number indicates higher potential. The PFYC is not intended to be



Legend

▭ Proposed PoO Boundary

▭ Cumulative Effects Study Area

▭ Mine Plan Boundaries

Source: BLM 2010c.

05/23/2012

Arturo Mine Project EIS

Figure 3.9-1

Paleontological Resources Cumulative Effects Study Area applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment. The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis and should be used to assist in determining the need for further mitigation assessment or actions. The BLM intends for the PFYC system to be used as a guideline as opposed to rigorous definitions. Descriptions of the potential fossil yield classes are summarized in **Table 3.9-1**.

Table 3.9-1 Potential Fossil Yield Classification

Class	Description	Basis	Comments
1	Igneous and metamorphic (tuffs are excluded from this category) geologic units or units representing heavily disturbed preservation environments that are not likely to contain recognizable fossil remains.	Fossils of any kind known not to occur except in the rarest of circumstances. Igneous or metamorphic origin. Landslides and glacial deposits.	The land manager's concern for paleontological resources on Class 1 acres is negligible. Ground disturbing activities will not require mitigation except in rare circumstances.
2	Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils.	Vertebrate fossils known to occur very rarely or not at all. Age greater than Devonian. Age younger than 10,000 years before present. Deep marine origin. Aeolian origin. Diagenetic alteration.	The land manager's concern for paleontological resources on Class 2 acres is low. Ground disturbing activities are not likely to require mitigation.
3	Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.	Units with sporadic known occurrences of vertebrate fossils. Vertebrate fossils and significant invertebrate fossils known to occur inconsistently; predictability known to be low. Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.	The land manager's concern for paleontological resources on Class 3 acres may extend across the entire range of management. Ground disturbing activities will require sufficient mitigation to determine whether significant paleontological resources occur in the area of a proposed project. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.

Table 3.9-1 Potential Fossil Yield Classification

Class	Description	Basis	Comments
4	Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.	Significant soil/vegetative cover; outcrop is not likely to be impacted. Areas of any exposed outcrop are smaller than 2 contiguous acres. Outcrop forms cliffs of sufficient height and slope to be out of reach by normal means. Other characteristics that lower the vulnerability of both known and unidentified fossil localities.	The land manager's concern for paleontological resources on Class 4 acres is toward management and away from unregulated access. Proposed ground disturbing activities will require assessment to determine whether significant paleontological resources occur in the area of a proposed project and whether the action will impact the paleontological resources. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.
5	Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant invertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.	Vertebrate fossils and/or scientifically significant invertebrate fossils are known and documented to occur consistently, predictably, and/or abundantly. Unit is exposed; little or no soil/vegetative cover. Outcrop areas are extensive; discontinuous areas are larger than 2 contiguous acres. Outcrop erodes readily; may form badlands. Easy access to extensive outcrop in remote areas. Other characteristics that increase the sensitivity of both known and unidentified fossil localities.	The land manager's highest concern for paleontological resources should focus on Class 5 acres. Mitigation of ground disturbing activities is required and may be intense. Areas of special interest and concern should be designated and intensely managed.

Sources: BLM 2008c, 2007c.

3.9.1.3 Paleontological Investigations in the Study Area

The important paleontological resources in the study area have a high potential of occurring in the tuffaceous materials in the Carlin Formation (Hockett 2010). Although igneous rocks would commonly be classified as having a low potential fossil yield, the special circumstances of the deposition of the Carlin Formation may have contributed to the preservation of fossils. The deposits consist of a combination of volcanic tuff, tuffaceous sediment, and non-volcanic detritus. The depositional environment likely helped preserve the bone material of dead animals as well as the high amount of silica contained in the volcanic ash. Limited discoveries of vertebrate and invertebrate fossils have been found in the Carlin Trend. Prehistoric camel and horse fossils were found in the Carlin Formation at the Gold Quarry Mine (BLM 2002a). Invertebrates also have been found in the vicinity of the Gold Quarry Mine. No plant fossils have been found in the study area or CESA. A locality within a few miles of the mine site near the Mud Springs Road consisted of vertebrate fossils that had been weathered out of the rock (BLM 2010j). Specimens from localities in the Willow Creek area have been placed on display at the Northeastern Nevada Museum in Elko (Hockett 2010). The Carlin Formation would rate 3 to 5 in the PFYC system for potential for scientifically valuable fossils. In areas where Carlin bedrock is not well exposed or is covered by surficial materials, the formation would probably rate a PFYC of 3.

The other geological units in the study area consist of alluvium, Slaven Chert, Vinini Formation, Elder Sandstone, and Bootstrap Limestone. Alluvium would be considered as having low potential for significant fossils. The Vinini Formation, Slaven Chert, Elder Sandstone, and Bootstrap Limestone contain invertebrate fossils including graptolites, echinoderms, and radiolarians (Theodore et al. 2006). The fossils may be potentially useful in determining the age and depositional environment except that the mode of deposition of the strata may have displaced the fossils from areas where they originally occurred (Western Cordillera 2006). The Paleozoic formations listed above would probably rate 2 in the PFYC system because of their age, lack of vertebrate fossils, marine deposition, and varying degrees of alteration of some of the units.

3.9.2 Environmental Consequences

Primary issues include the classification of bedrock formations in the study area with respect to the PFYC in order to assess potential impacts to scientifically important paleontological resources.

3.9.2.1 Proposed Action

No vertebrate, invertebrate, or plant fossils have been discovered at the proposed Arturo site. Destruction, damage, or loss of fossils would potentially occur from general construction activities, waste rock disposal, and pit development in the Carlin Formation, which has a potential to contain scientifically important fossils, especially vertebrates. However, recent surveys of the Carlin Formation within the vicinity of the proposed project and CESA have resulted in the collection of few recognizable vertebrate fossils. Most of the fossil material consisted of fragments of fossilized bone of limited scientific value because of the fragmented nature of the material and the fact the material has been eroded from its original place of deposition (Erathem-Vanir 2010). Therefore, it is possible that important fossils may be unearthed during mining activities.

Much of the Carlin Formation that is exposed in the proposed PoO boundary would be covered by waste rock in the West Waste Rock Disposal Facility (WRDF). Also, previously undisturbed outcrops of Carlin Formation would be impacted by the development of the open pit and heap leach facility. Indirect impacts from mining activities would include unauthorized collection of scientifically important fossils by workers. There is a very low risk of impacts to fossils on previously authorized disturbed lands. Also, proposed disturbance is not likely to affect paleontological resources in the Paleozoic rocks and alluvium since these rock units have a low potential to contain scientifically important fossils.

3.9.2.2 Single Waste Rock Disposal Facility Alternative

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres (**Table 2-14**). Overall, this alternative would result in approximately 128 fewer acres of disturbance. Implementation of this alternative would result an additional 26 acres of disturbance within the Carlin Formation. All other direct and indirect impacts associated with this alternative would be the same as described for the Proposed Action.

3.9.2.3 Partial Pit Backfill Alternative

Under the Partial Pit Back Fill Alternative, there would be no change in surface disturbance footprint compared to the Proposed Action. As a result, direct and indirect impacts associated with the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.9.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and impacts to paleontological resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations. No additional ground-disturbing activities beyond those currently authorized would occur at the mine site.

3.9.3 Cumulative Impacts

The CESA for paleontological resources is defined in Section 3.9.1, Affected Environment, and is shown in **Figure 3.9-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.9.3.1 Proposed Action

The various mines and other past, present, and RFFAs (e.g., utility and energy development and community development) developments in the CESA are located on a variety of bedrock formations with widely varying fossil potential so that not all disturbances would pose a risk to fossil resources. Therefore, the cumulative impacts to paleontological resources within the CESA would be difficult to quantify for past, present, and RFFAs. Incremental adverse effects to paleontological resources from the development of the proposed project would be small because of the disturbance that has already taken place where the Carlin Formation outcrops in the CESA (Moore 2002; Norby 2002; Theodore et al. 2006).

3.9.3.2 Single Waste Rock Disposal Facility Alternative

The incremental increase of potential disturbance to the Carlin formation would be similar to cumulative effects associated with the Proposed Action, except that there would be approximately 128 fewer acres of disturbance under this alternative.

3.9.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be the same as described for the Proposed Action.

3.9.3.4 No Action Alternative

There would be no cumulative impacts from the No Action Alternative.

3.9.4 Potential Monitoring and Mitigation Measures

The following mitigation measures are recommended for paleontological resources.

Issue: Potential impacts to unique or site-specific invertebrate, vertebrate, or paleobotanical fossils, if present, requiring protection under FLPMA and BLM Manual H-8270.

Mitigation Measure P-1: The following procedures would ensure protection of potential paleontological resources within the study area.

- Field surveys would be conducted in areas underlain by the Carlin Formation that would be affected by construction, pit expansion, or waste rock storage. The field surveys would identify if there are surface exposures containing visible fossils and if there is a potential for buried fossils within the disturbance footprint. If any important fossils are found during the field survey, a program would be developed and implemented to remove any exposed fossils prior to ground disturbing activities.
- Construction areas identified as having a high potential for buried paleontological resources based upon the field survey would be monitored by a qualified paleontologist during ground disturbance, including grading, excavation, and trenching.
- Any fossils recovered during the field survey or construction monitoring would be prepared in accordance with standard professional paleontological techniques. A report on the findings of the salvage program, including a list of the recovered fossils, would be prepared following completion of the program. A copy of this report would accompany the fossils to the BLM-approved facility where they would be curated.

Effectiveness: This measure would allow for the evaluation of any fossils that may be discovered and provide adequate time for their preservation or data recovery.

3.9.5 Residual Impacts

If no fossils exist within the proposed project area, there would be no residual impacts to paleontological resources. There would be few residual impacts to paleontological resources if fossils are discovered, with the implementation of the mitigation measures listed above. The foremost impact would be the loss of potentially important fossil that would be buried in the West WRDF.

3.10 Social and Economic Values

3.10.1 Affected Environment

The study area and the Cumulative Effects Study Area (CESA) for social and economic values includes Elko County and Eureka County, with particular focus on the communities of Elko, Carlin, and Spring Creek (**Figure 3.10-1**). The rationale for the study area and CESA is that the mine would be located in Elko County, adjacent to the Eureka County line, and the primary access would pass through northern Eureka County. The mine may generate public revenue for both counties while a substantial majority of the workers would be expected to live in west central Elko County due to the proximity, housing availability, and availability of a broad range of public and private services. Because of the expected dominance of Elko County as a residence location of choice for project employees, the following discussion focuses primarily on Elko County.

The social and economic values assessment is focused on issues relevant to the proposed project. Because of the amount of previous analysis in recent years, this report is tiered to studies conducted for the Betze Pit Expansion Project, the Leeville Project, and the South Operations Area Project Amendment (Bureau of Land Management [BLM] 2010a,b, 2008b). Project related effects are analyzed in the context of the existing regional community and cumulative development activities addressed in the Leeville and South Operations Area Supplemental Environmental Impact Statements (BLM 2010a,b).

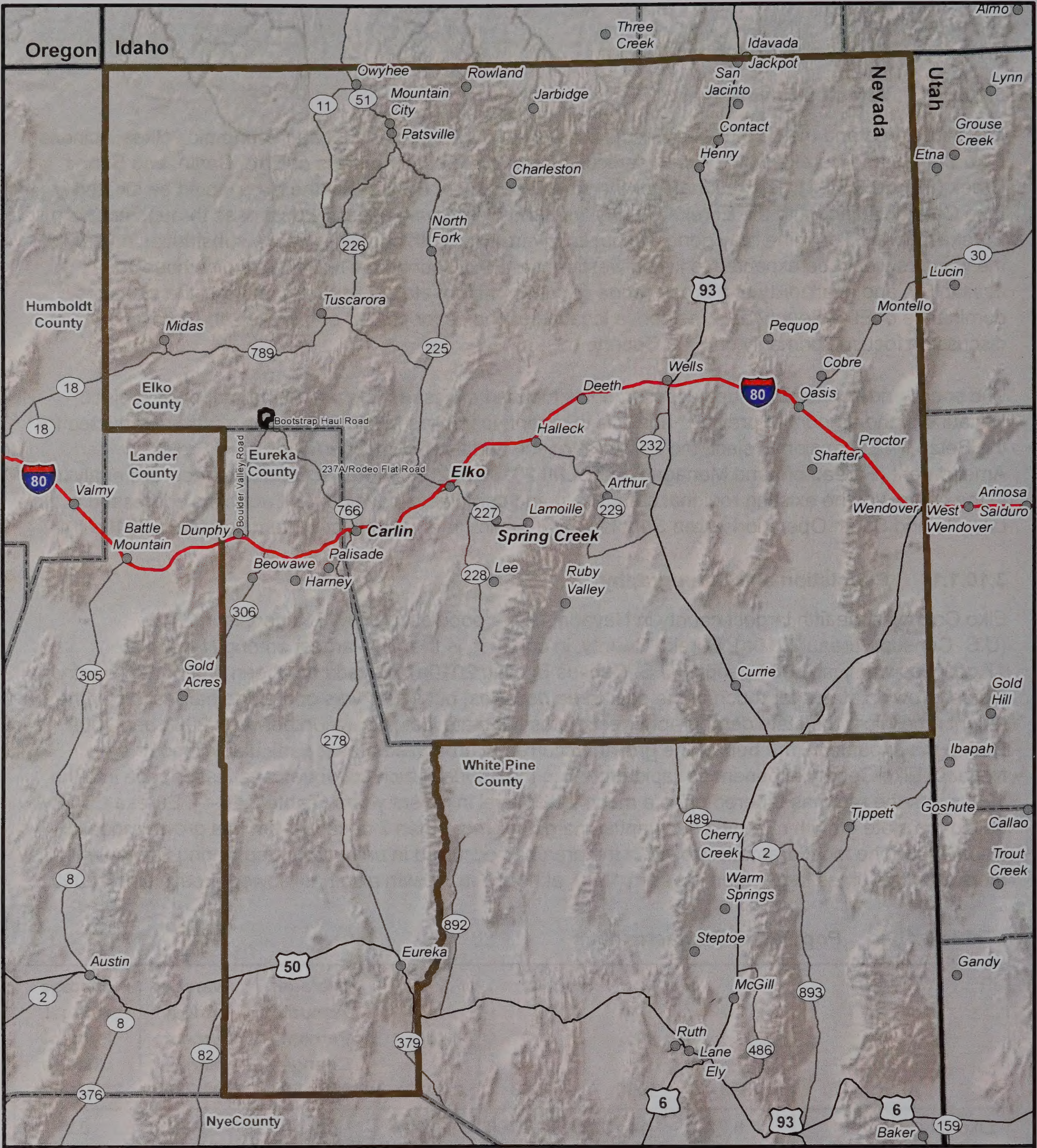
3.10.1.1 Population and Demography

Elko County is the fifth largest county in Nevada, with a population of 48,818 people in 2010 (U.S. Census Bureau 2010a). Eureka County, in contrast, is the 16th largest among Nevada's 17 counties with just 1,987 people (U.S. Census Bureau 2010a). Nevada has been one of the country's fastest growing states for much of the past three decades, but it also was one of the hardest hit by the recent recession: the state demographer estimates the state lost population between 2008 and 2009. During the expansion, the bulk of the growth occurred in urbanized areas, particularly in southern Nevada. Elko County experienced rapid growth in the 1980s, which continued at a lesser pace into the 1990s, but the rate has tapered off to a much lower level in recent years (**Table 3.10-1**). Eureka County trailed the state growth rate by a substantial margin for more than 2 decades, but has grown modestly since 2000. The most dramatic growth in the area has occurred in unincorporated Spring Creek, which is more than five times larger than it was in 1980, although its growth also has slowed greatly since 2000.

Table 3.10-1 Population Characteristics

Area	1980	1990	2000	2010	Average Annual Percent Change 1980-1990	Average Annual Percent Change 1990-2000	Average Annual Percent Change 2000-2010
Elko City	8,771	14,736	16,708	18,297	5.3	1.3	0.9
Spring Creek Census Designated Place	2,002	5,866	10,548	12,361	11.3	6.0	1.6
Carlin	1,233	2,220	2,161	2,368	6.1	(0.3)	0.9
Elko County	17,269	33,530	45,291	48,818	6.9	3.1	0.8
Eureka County	1,198	1,550	1,651	1,987	2.6	0.6	1.9
Nevada	800,493	1,201,833	1,998,257	2,700,551	4.1	5.2	3.1

Source: U.S. Census Bureau 2010a, 2000, 1980.



Legend

☐ Proposed PoO Boundary

▨ Cumulative Effects Study Area

N

0 10 20 Miles

Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.10-1

Social and Economic Values Cumulative Effects Study Area

05/16/2012

Workers typically choose a residence location based on some combination of job proximity, housing availability, and access to public and private services. Currently, much of the mining work force in the Carlin Trend resides in the Elko vicinity because it is the most accessible community with a broad selection of services and housing. Carlin also is a popular residence location due to its accessibility to work locations.

Both Elko and Eureka counties are notably less ethnically and racially diverse than the state as a whole. Eureka County, in particular, is over 83 percent white, non-Hispanic, compared with nearly 69 percent for Elko County, and 54 percent for Nevada (**Table 3.10-2**). Elko County has fewer than 1 percent blacks or Asians, but over 22 percent Hispanic, compared with 26 percent for the state. Elko County also has a higher percentage of American Indian, Eskimo, or Aleut population with 4.7 percent compared with the state's 0.9 percent (U.S. Census Bureau 2010a). This is largely attributable to the presence of the Elko Band Colony, one of four colonies that comprise the Te-Moak Tribe of Western Shoshone with headquarters in Elko.

Table 3.10-2 Race and Ethnicity by County

	Elko	Eureka	State of Nevada
White Not of Hispanic Origin	69.1	83.6	54.1
Black Not of Hispanic Origin	0.7	0.1	7.7
American Indian, Eskimo, or Aleut	4.7	2.1	0.9
Asian or Pacific Islander Non-Hispanic	1.0	0.9	7.7
Other and Two or More Races	1.7	1.3	3.1
Hispanic Origin of Any Race	22.9	12.0	26.5

Source: U.S. Census Bureau 2010.

3.10.1.2 Income

Mining wages and salaries are the highest for any industry in Nevada, averaging $54,024 in 2009, more than 38 percent higher than the all-industries average of $39,004 (Nevada Department of Employment Training, and Rehabilitation [NDETR] 2010a). The differential holds true for the study area, as well, with average natural resources and mining wages reported at $50,277 in Elko County and $56,830 in Eureka County. All-industry average wages were reported at $34,754 in Elko County and $52,772 in Eureka County, although the Eureka County figure is heavily skewed since nearly 90 percent of all employment in the county is mining related (NDETR 2010a). The only industry sector that comes close to matching mining industry wages is in the education and health services sector, which includes well paid health care professionals.

Although mining wages and salaries are typically higher than average, per capita personal income (PCPI) in the study area continues to lag slightly behind the state level; data from 2000 indicated a state income average of $30,986. Average PCPI for study area counties in 2000 was $25,418 (82.0 percent of the state level) in Elko County and $23,757 (76.7 percent of the state level) in Eureka County (Bureau of Economic Analysis [BEA] 2010). By 2008, the state PCPI had risen to $40,936, an increase of 32 percent. The PCPI was $37,300 for Elko County and $40,674 for Eureka County. PCPI for counties within the study area had grown faster than the state's PCPI and had risen to 91.1 percent of the state level in Elko County and 99.4 percent of the state level in Eureka County (BEA 2010). In contrast to PCPI, the median household income for the state for 2008 was estimated at $56,432, compared with $70,125 for Elko County (124.3 percent of the state level) and $55,090 for Eureka County (97.6 percent of the state level) (U.S. Census Bureau 2009).

An estimated 7.5 percent of Elko County's population and 10 percent of Eureka County's population were considered to be living in poverty in 2008 according to census estimates (U.S. Census Bureau 2009). Both were lower than the statewide rate of 11.2 percent. The rates for children and youth under 18 also were lower than state rates (U.S. Census Bureau 2009).

3.10.1.3 Economy and Employment

Elko and Eureka counties are major contributors to Nevada's mining industry. **Table 3.10-3** illustrates a comparison of the two counties' employment by major industry with statewide employment by the same sectors. The employment numbers are based on place of work, not place of residence, which explains Eureka County having more employees in the natural resources and mining sector than it has residents. Several major mines in the Carlin Trend are located in Eureka County; however, as noted above, most workers reside in Elko County. The two counties account for 44 percent of all mining employment in Nevada. Nearly 89 percent of all employment in Eureka County is mining and natural resource related. Elko County, in contrast, has a substantial casino and hospitality industry and offers a variety of other services, which notably broadens its base of employment.

Table 3.10-3 Nonagricultural Wage and Salary Employment[1] by Sector

	Nevada		Elko County		Eureka County	
	Employees	Percent	Employees	Percent	Employees	Percent
Goods Producing - Private	179,101	14.3	3,949	18.5	3,958	88.9
Natural Resources and Mining	14,570	1.2	2,475	11.6	3,958	88.9
Construction	116,448	9.3	1,253	5.9	*	0.0
Manufacturing	48,083	3.8	221	1.0	*	0.0
Service Providing - Private	916,345	73.1	13,616	63.7	196	4.4
Trade, Transportation, Warehouse, and Utilities	230,747	18.4	3,806	17.8	129	2.9
Information	15,077	1.2	186	0.9	*	0.0
Financial Activities	61,482	4.9	543	2.5	*	0.0
Professional and Business Services	152,007	12.1	973	4.6	14	0.3
Educational and Health Services	95,343	7.6	1,299	6.1	*	0.0
Leisure and Hospitality	332,546	26.5	6,192	29.0	45	1.0
Other Services	29,143	2.3	617	2.9	8	0.2
Unclassified[2]	1,375	0.1	15	0.1	92	2.1
Subtotal - Private	1,096,821	87.5	17,580	82.3	4,246	95.4
Service Providing - Public	156,122	12.5	3,787	17.7	204	4.6
Government	156,122	12.5	3,787	17.7	204	4.6
Subtotal - Public	156,122	12.5	3,787	17.7	204	4.6
Total	1,252,943	100.0	21,367	100.0	4,450	100.0

[1] 2008 Annual Averages.

[2] County unclassified numbers include aggregated data not released by industry for reasons of confidentiality.

* Not cited in table.

Source: NDETR 2009.

The Elko County School District is the largest single employer in the county; the next five largest employers are all casinos. The top two, and three of the top five, largest employers in Eureka County are mining companies. Barrick Goldstrike Mines Inc. (BGMI) is the second largest employer in Eureka County, with slightly over 1,600 employees (NDETR 2009).

The combined labor force in the two counties is currently estimated at 28,275, approximately 25,981 of whom are employed. The remaining 2,294 unemployed individuals represent an 8.1 percent unemployment rate. This level is notably lower than the 13.0 percent statewide unemployment rate and somewhat lower than the national rate, estimated at approximately 9.7 percent (NDETR 2010b). Unemployment rates for both counties have risen dramatically in the last 3 years, as they have all over Nevada. Current rates are approximately double their 2007 average annual rates.

3.10.1.4 Housing

The 2010 census found 19,566 housing units in Elko County and 1,076 units in Eureka County. At the time, 17,442 units were occupied in Elko and 2,124 (10.9 percent) were vacant (**Table 3.10-4**). Some of the vacant units were seasonal, recreational, or for occasional use only. Vacancy rates were at a very modest 1.3 percent in homeowner units, but 10.2 percent in rental units (U.S. Census Bureau 2010a). Vacancy rates varied geographically as well as by type. The Spring Creek area had a 96 percent occupancy rate, while Elko was at 93 percent and Carlin 85 percent. Eureka County had 240 vacant housing units in 2010, which was 22 percent of the total 1,076 units. A modest 3.3 percent of homeowner units were vacant, but a substantial 11.9 percent of rental units were vacant (U.S. Census Bureau 2010a).

Table 3.10-4 2010 Housing Vacancy Rates

	Housing Units			Vacancy Rates (percent)		
Geographic Area	**Total**	**Occupied**	**Vacant**	**Total**	**Homeowner**	**Rental**
Elko	7,221	6,743	478	6.6	0.9	6.9
Spring Creek Census Designated Place	4,394	4,204	190	4.3	1.2	4.6
Carlin	1,043	882	161	15.4	1.0	21.3
Elko County	19,566	17,442	2,124	10.9	1.3	10.2
Eureka County	1,076	836	240	22.3	3.3	11.9

Source: U.S. Census Bureau 2010a.

The vacancy rates in the study area suggest a tight housing market for owner occupied units likely based on the diversity in the county's economy and the relative health in the mining industry in recent years. Vacancy rates for rental units are less constrained in most of the study areas.

Short-term housing opportunities in the study area are available. Elko has 31 motels, hotels, and casinos hosting over 2,000 rooms. There are several mobile home parks and 6 recreational vehicle parks in the city with approximately 500 spaces. There also are several campgrounds in the surrounding area, several of which are on BLM lands. Carlin has a 61 room Comfort Inn and 2 small, older motels plus limited opportunities for weekly rentals.

3.10.1.5 Community Facilities and Services

Public Utilities

Water

The City of Elko obtains municipal water from 18 deep-water wells and has 25 million gallons of storage capacity. The system has a maximum production capacity of 14.5 million gallons per day (mgd) with current usage ranging from 3 mgd to a peak of 13 mgd. Spring Creek residents are served by nine public wells. Carlin obtains water from one deep-water well and several natural springs; water is stored in a 2 million gallon tank. Peak production capacity is 980 gallons per minute (gpm), or approximately 1.4 mgd; production averages 450 gpm.

Wastewater

Elko and Carlin have wastewater treatment facilities. Elko's is a fixed film biological treatment plant averaging 3.5 mgd. Approximately 60 percent of treated water is reused for irrigation. Carlin employs two lagoons with rapid infiltration basins. Wastewater treatment in Spring Creek utilizes private septic systems.

Solid Waste

The City of Elko operates a regional solid waste landfill. At current use rates, it has capacity for in excess of 200 years.

Energy

Electricity is provided to study area residents by Nevada Energy. Southwest Gas Corporation provides natural gas except in Spring Creek where propane is supplied by Wells Propane and Suburban Propane.

Public Safety

Law Enforcement

Law enforcement in unincorporated Elko County is provided by the County Sheriff. Elko and Carlin police departments are responsible for their respective incorporated jurisdictions. The Bureau of Indian Affairs Police is responsible for the 193-acre Elko Band Colony. The Eureka County Sheriff provides law enforcement for rural Eureka County. The Nevada Highway Patrol provides law enforcement on the state highway system.

Fire Protection

Fire protection services in the study area are provided by the City of Elko Fire Department, the Carlin City Volunteer Fire Department, the BLM, the United States Forest Service, and the northeastern Fire Protection Department of the Nevada Division of Forestry. These departments are all involved in mutual aid cooperative agreements. The Elko City Department is the largest of the agencies with 3 staff positions and 15 career firefighters supported by 34 volunteer positions. The department has 10 major pieces of equipment, including 7 regular engines, 2 smaller specialty trucks, and a specialized airport engine. The department also houses 4 pieces of Nevada Department of Forestry firefighting equipment. The Elko and Carlin fire departments primarily serve residents within their city limits and the Elko Band Colony. The BLM is primarily responsible for fighting wildland fires (BLM 2010b).

Health Care

The Northeast Nevada Regional Hospital in Elko is the principal health care facility for all of northeastern Nevada. It provides 24-hour emergency care and has 75 acute care rooms. The hospital has a full service laboratory, an intensive care unit, magnetic resonance imaging, and computerized axial tomography scan capabilities, and provides most major medical specialty services (Northeast Nevada

Regional Hospital (2010). The hospital also provides services to the Elko Band Colony Health Center under an Indian Health Service contract.

The Carlin Community Health Center is one of a series of federally supported clinics providing health care to medically underserved areas operated by Nevada Health Centers, a private, non-profit organization. The Carlin clinic is staffed by physicians, physician assistants, and nurse practitioners. The center provides services in family medicine, preventative health, women's health, children's health and immunizations, health education, prenatal and newborn care, and pharmacy services.

Education

Elementary and secondary schools in the study area are operated by the Elko County School District with administrative offices in Elko. The district serves the entire county and had a fiscal year (FY) 2010 enrollment of 9,474 pupils from pre-kindergarten through 12th grade on count day, for a 2.0 percent decrease from FY 2009 (**Table 3.10-5**).

Table 3.10-5 Public Schools Enrollment History – Elko County School District

Year	Enrollment by Grade Level[1]						Percent Gain/Loss Over Prior Year
	Pre-Kindergarten[2]	Kindergarten	Elementary (1-6)	Secondary (7-12)	Ungraded[3]	Total	
2005-2006	57	747	4,512	4,495	19	9,830	0.9
2006-2007	59	741	4,545	4,546	16	9,907	0.8
2007-2008	61	690	4,538	4,509	13	9,811	-1.0
2008-2009	65	676	4,441	4,470	17	9,669	-1.4
2009-2010	78	754	4,225	4,407	10	9,474	-2.0
					5-Year Net Change		-3.6

[1] Enrollments at the end of the first school month.

[2] Pre-kindergarten refers to 3- and 4-year olds receiving special education (Nevada Administrative Code [NAC] 388.490).

[3] Ungraded refers to a student enrolled in a non-graded class in a school for special education or a student who cannot be assigned to a particular grade because of the nature of his or her condition (NAC 387.111).

Source: Nevada Department of Education 2010a,b, 2009.

Eleven of the district's schools are located in the Elko-Spring Creek-Carlin area. Elko has four elementary schools, one junior high, and one high school. Spring Creek has two elementary schools, a middle school, and a high school. Carlin has a combined school for elementary through high school. The district has an overall ratio of 16.2 students per teacher.

Students from the Elko Band Colony attend Elko District schools. There also is a Head Start Program at the Colony for children 3 to 5 years old.

The primary provider of higher education opportunities to residents in the study area is Great Basin College (GBC). The college, a pioneer in distance learning techniques, serves nearly 4,000 students in six of Nevada's largest rural counties (GBC 2008). Its main campus, and only residential facility, is located in Elko. GBC also has a center with extensive course offerings in Winnemucca and a site with limited offerings in Battle Mountain, in addition to campuses elsewhere in the region.

3.10.1.6 Public Finance

There are four main general governmental entities influencing the study area: Elko and Eureka counties, and the cities of Elko and Carlin. Elko County has a professional county manager and a five-member Board of Commissioners, who oversee the operations of the county, including administration, law enforcement, courts, and public works. Eureka County operates with a three-member Board of Commissioners, who functions as both policy makers and administrators. Both the City of Elko and the City of Carlin employ council-manager governmental structures with professional city managers and policy making City Councils, each comprised of a directly elected Mayor and four Council Members.

Local government finance in Nevada is a complex admixture of locally derived and state shared revenues. Local revenues are primarily ad valorem property taxes on real and personal property and the net proceeds of mines in the jurisdiction. State shared revenues include sales, motor vehicle, fuel, and gaming taxes. State revenue sharing addresses significant economic disparities between the relatively wealthy urban centers of Reno and Las Vegas and the often less affluent rural agricultural and mining communities.

Both Elko County and Eureka County approved deficit budgets for FY 2009-2010, with plans to tap reserves to cover the current revenue shortfalls (**Table 3.10-6**). Elko County anticipated revenues of $37.8 million against planned expenditures of $84.7 million, resulting in an expected deficit of $46.9 million. Eureka County anticipated revenues of $14.0 million and expenditures of $30.0 million. The City of Elko's FY 2009-2010 budget anticipated revenues of $19.4 million and expenditures of $22.1 million, producing a $2.7 million deficit. The much smaller City of Carlin planned revenues of $2.1 million and expenditures of $2.0 million, leaving an $83,000 surplus.

Table 3.10-6 County and City Budgets Fiscal Year 2009-2010

	Governmental Fund Types and Expendable Trust Funds ($)			
	City of Elko	**City of Carlin**	**Elko County**	**Eureka County**
Revenues				
Property Taxes	3,435,522	291,859	10,022,823	4,919,814
Other Taxes	2,556,447	61,000	14,000	120,670
Licenses and Permits	1,478,905	60,700	892,000	8,250
Intergovernmental Resources	10,711,849	1,476,890	19,043,586	6,542,892
Charges for Services	756,404	91,699	2,607,500	1,364,100
Fines and Forfeits	289,000	19,050	1,218,000	113,400
Miscellaneous	172,130	111,152	3,965,000	894,250
Total Revenues	19,400,257	2,112,350	37,762,909	13,963,376

Table 3.10-6 County and City Budgets Fiscal Year 2009-2010

	Governmental Fund Types and Expendable Trust Funds ($)			
	City of Elko	**City of Carlin**	**Elko County**	**Eureka County**
Expenditures				
General Government	2,491,008	631,989	13,536,327	10,408,551
Judicial	407,000	65,550	10,216,382	1,273,150
Public Safety	9,006,378	555,142	10,275,455	3,035,100
Public Works	5,598,024	220,831	7,839,305	4,402,600
Sanitation	--	--	--	332,000
Health[1]	578,440	94,785	344,360	1,105,824
Welfare[1]	--	--	2,519,455	--
Culture and Recreation	3,354,042	295,535	1,725,794	1,178,659
Community Support	36,000	52,850	10,664,391	812,807
Intergovernmental Expenditures	--	--	4,002,249	7,195,000
Capital Projects	--	--	--	--
Contingencies	254,444	50,000	450,000	300,000
Utility Enterprises	--	--	--	--
Hospitals	--	--	20,307,018	--
Transit Systems	--	--	--	--
Airports	--	--	--	--
Other Enterprises	--	--	--	--
Debt Service - Principal	336,500	43,957	1,849,219	--
Interest Cost	**78,169**	**18,458**	**932,597**	**--**
Total Expenditures	**22,061,836**	**2,010,639**	**83,729,955**	**30,043,691**
Excess Revenues Over (Under) Expenditures	**(2,739,748)**	**83,253**	**(46,899,643)**	**(16,080,315)**

[1] The cities of Elko and Carlin combine Health and Welfare into one line item; Eureka County does not have a welfare line item.

Source: Nevada Department of Taxation 2010a.

In all cases, the available, unreserved fund balances would be sufficient to cover the budgeted shortfalls, although, in some cases, the reserve funds would be substantially reduced if the budgeted shortfalls should actually occur. Elko County, as an example, chooses to budget conservatively by underestimating revenue for the forthcoming year and appropriating every dime for expenditures (Armuth 2008). The county's experience with this approach has been that, at the end of a fiscal year, actual revenue has exceeded their projections and expenditures because most funds rarely reach the appropriated levels (Armuth 2008). The result has been that the county's ending fund balance has held firm or only declined modestly in recent years (Armuth 2008). If the year's revenue and expenditure streams should play out close to the budgeted amounts, Elko County's unreserved fund balance would drop from over $53 million to under $7 million, although indications are that the actual decline would be substantially smaller. After covering the budgeted deficit, Eureka County would still have an unreserved fund balance of over $22 million.

The two largest revenue sources for all four local governments are projected to be property taxes and intergovernmental transfers. Expenditure emphases vary notably among jurisdictions as illustrated in **Table 3.10-6**.

Eureka County has experienced substantial increases in its property tax base from FY 2009 to FY 2010; Elko County's tax base has grown much slower. Both counties benefit from taxes on net proceeds of mines. Net proceeds of all mines constitute over 40 percent of the total assessed valuation in Eureka County, but slightly less than 9 percent of Elko County's total assessed valuation. Elko County's ad valorem tax rate was $0.8386 per $100 of assessed value for FY 2009-2010; Eureka County's rate was a similar $0.8458 per $100 of assessed value. Net proceeds of mines constitute only a small fraction of the total assessed valuation in the City of Elko and none of Carlin's assessed valuation.

Sales tax rates in Nevada counties held constant at 6.5 percent in most rural counties for several years, but increased after the Legislature raised the local school support tax from 2.25 percent to 2.60 percent in 2009. Both Elko County and Eureka County now collect 6.85 percent sales and use tax. The mine purchases material and services in both counties, generating sales and use tax payments to both. The counties do not realize all the benefits of the total sales and use tax payments, however, because a portion (2 percent of the 6.85 percent collected) goes to the state general fund and 2.6 percent goes to school districts. The county where the tax is generated receives 0.5 percent and the remaining 1.75 percent is distributed to all counties under a statutory formula (Nevada Department of Taxation 2010b).

3.10.1.7 Social Conditions

Elko, Spring Creek, and Carlin, in western Elko County, grew very rapidly in the 1980s, due to a boom in mining and related support activities, but stabilized in subsequent years when they experienced years of modest population growth and decline through about 2003. Growth resumed in recent years but at moderate rates. The passage of time and the community's ability to weather not only the booms, but subsequent downturns, have allowed for development of a relatively stable social setting that now exists in Elko County. Many residents have lived in the area for a number of years, social ties have become established, and residents take pride in their communities. Many of the people place a high priority on maintaining informal lifestyles and small town traditions.

"Social stratification in the area is often defined by income, length of residence, educational attainment, and ethnicity. Local residents earning high incomes are considered to be the most influential in the community. The most powerful groups viewed by residents as making decisions about the area's future include federal and state government, county commissioners, environmental organizations, and large corporations" (BLM 2010b).

Gold prices continue to be a significant factor driving the growth or decline of the communities. When prices dropped in the late 1990s, workers were laid off, some mines announced early closures, and expansion plans were mothballed. As prices have risen recently, the reverse is true. Several mines are implementing growth plans to take advantage of the opportunity. Although Elko County is more diversified than it was two decades ago, the mining industry is still an important sector, affecting both the economy and the psychology of area communities.

3.10.2 Environmental Consequences

The primary issues related to social and economic values include: 1) effects associated with potential changes in long-term local population, employment, or earnings associated with construction or operation of the proposed project; 2) potential project-related demands for housing and public services or infrastructure that would exceed capacities in these systems; 3) potential project-related effects on public sector fiscal conditions regarding demand for services compared to revenue generated; and 4) potential effects of the No Action Alternative relative to local work force and employment conditions.

3.10.2.1 Proposed Action

Construction of the proposed project is anticipated to begin in early 2013 and last approximately 8 months. During that time, a construction work force of approximately 90 contract workers and 10 Barrick Dee Mining Venture (BDMV) workers would be employed (Section 2.3.7, Schedule and Work Force). At completion of construction, operations would begin with a work force consisting of approximately 143 workers. As noted in **Table 3.10-7**, the total employment level would grow to a maximum of approximately 379 workers in 2016, and would decrease to approximately 50 workers in 2020. Approximately 15 workers would remain from 2021 through 2024 as closure and final reclamation activities are completed. It is expected that the project would terminate at the end of 2024, except for long-term monitoring and fluid management activities (**Figure 2-10**).

Table 3.10-7 Arturo Mine Project Employment by Year

Employees/Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Salaried	22	28	31	32	27	29	21	8	3
Hourly	121	257	327	347	227	253	122	42	12
Total Employees	143	285	358	379	254	282	143	50	15

Source: BDMV 2011a, 2010f.

Employment is one of the key driving forces in determining the social and economic effects of a proposed project. In this case, however, there is a range of possible scenarios for how the employment would be implemented by BDMV (BDMV 2010f). It could be that the needed workers would be all, or nearly all, new hires. At the opposite extreme, all, or nearly all, of the workers could be transferred from current positions at other Barrick operations, particularly the BGMI project, for example. The actual scenario would probably lie somewhere in between the extremes. In general, the effects would be similar, except that the timing might differ. The total employment and payroll would likely be the same as any transfers would probably be surplus workers who might otherwise be laid off from their current projects. The following analysis will address the range of possibilities as succinctly as possible.

Income and Employment

Construction

Construction would require a modest work force of 100 for approximately 8 months. Indirect employment generated by the construction activity is projected at approximately 20 additional jobs, raising the temporary construction impact to 120 workers (**Table 3.10-8**). Considering the relatively small number of workers needed, the short construction period, and the nearly 2,300 unemployed individuals in the study area, local labor is expected to provide 90 percent of the direct project workers and all of the indirect workers during construction, leaving a need for very few workers from outside the local area. The employment impact during construction represents less than 0.4 percent of total employment in the two-county study area. It would lower the unemployment rate from 8.1 percent to 7.7 percent. This would be the maximum estimated effect based on all of the construction jobs being filled by new employees rather than transfers from other projects.

Table 3.10-8 New Construction-related Employment, Households, and Population Projections

New Construction-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
90	10	100	20	0	20	110	10	120

New Construction-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	10	0	--
Single	10	0	10
Married - 1 Worker	0	0	0
Married - 2 Workers	0	0	0
New Households	**10**	**0**	**10**

New Construction-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-age	Other	Total
Single Households	10	10	0	0	10
Married Households	0	0	0	0	0
Total	**10**	**10**	**0**	**0**	**10**

[1] Work force was assumed to be 90 percent local, 10 percent non-local.

[2] Indirect employment was calculated using an employment multiplier of 1.2; the indirect work force was assumed to be 100 percent local.

[3] Non-local direct work force was assumed to be 100 percent single or married without families present.

[4] Indirect work force was assumed to be 40 percent single or married without families present; half the married worker households were assumed to be two-worker families.

[5] Population estimates were based on one person per single family household and 2.7 persons per married household.

[6] Eighty percent of children were assumed to be of school age.

Direct payroll to construction workers, including the value of benefits, is projected to be approximately $5.6 million. Much of this would be spent locally for items such as food, clothing, fuel, and rent, stimulating the local economy, particularly if, as anticipated, most of the construction workers come from the local area.

Operations

Operations employment would start at 143 workers in 2013 and grow rapidly to the peak of 379 workers in 2016. It would decline progressively to 50 workers in 2020 (**Table 3.10-7**). At its peak, the maximum employment effect would be approximately 659 workers, including indirect employment (**Table 3.10-9**). This level is considered the maximum for several reasons. As noted above, it is uncertain how many of the project employees would be new hires - which would theoretically generate indirect jobs based on the multiplier effect - as opposed to transferees from other local projects. If some or all of the jobs at the proposed project were filled by transferees, the indirect employment they would support would already be included in the local economy and the effect would be one of sustaining existing economic activity rather than generating new activity. The employment effects noted in **Table 3.10-9** also are considered to be maximums because direct project employment above 350 workers would last for just 2 years. It is likely that indirect employment changes would not respond as quickly as direct employment, although much of the economic activity generated by worker expenditures still would occur.

Table 3.10-9 Proposed Action - New Operations-related Employment, Households, and Population Projections

New Operations-related Employment								
Direct[1]			**Indirect**[2]			**Total**		
Local	**Non-local**	**Total**	**Local**	**Non-local**	**Total**	**Local**	**Non-local**	**Total**
303	76	379	252	28	280	555	104	659

New Operations-related Households			
	Direct[3]	**Indirect**[4]	**Total New Households**
New Non-local Workers	76	28	--
Single	19	7	26
Married - 1 Worker	51	11	62
Married - 2 Workers	3	5	8
New Households	**73**	**23**	**96**

New Operations-related Population					
		Population[5]			
			Children[6]		
	Households	**Adults**	**School-age**	**Other**	**Total**
Single Households	26	26	0	0	26
Married Households	70	140	40	10	190
Total	**96**	**166**	**40**	**10**	**216**

---

[1] Work force was assumed to be 80 percent local, 20 percent non-local.

[2] Indirect employment was calculated using an employment multiplier of 1.74; the indirect work force was assumed to be 90 percent local and 10 percent non-local.

[3] Direct work force was assumed to be 25 percent single or married without families present; 10 percent of the married worker households were assumed to be two-worker families.

[4] Indirect work force was assumed to be 25 percent single or married without families present; half the married worker households were assumed to be two-worker families.

[5] Population estimates were based on one person per single family household and 2.7 persons per married household.

[6] Eighty percent of children were assumed to be of school age.

Because there are approximately 2,300 unemployed individuals in the two-county study area, it is assumed that most of the workers needed for the proposed project would be available locally. The calculations in **Table 3.10-9** assume that local workers would fill approximately 80 percent of direct project jobs and 90 percent of the indirect jobs during operation of the proposed project. An estimated 104 workers from outside the local area would be needed during the peak year. The 2016 peak employment during operations would represent a 2.6 percent increase over total 2008 employment in the two-county study area. It would reduce the unemployment rate to approximately 5.8 percent, if all of the jobs were filled by new hires from the local area.

The employment effects would be proportionally less than those described during earlier and later years of the proposed project.

The estimated average annual payroll, including benefits, for proposed project salaried and hourly workers combined would be $84,000. Consequently, the direct payroll would range from $4.2 million (2020) to $31.8 million (2016) and would total approximately $159.1 million during the 8-year operating life of the mine. Each $1.00 in direct earnings would indirectly generate $0.37 in earnings to other workers in the local economy (BEA 2010; Dobra 1988; Price and Harris 2007). Consequently, the annual indirect earnings effect would range from $1.5 million to $11.8 million and the total combined effect would be $218.0 million during the operating life of the project. The increase in income earnings would be a substantial economic benefit accruing to the local economy.

Population

Anticipated population increases resulting from construction and operation of the proposed project are presented in **Tables 3.10-8** and **3.10-9**, respectively. The figures include population effects from anticipated indirect or secondary employment.

Construction

Population effects from construction would be very small and of short duration. Considering the relatively small number of construction workers required, it is likely that most would be available locally or at least within commuting distance. In the event non-local construction workers would be needed, the short, 8-month construction period suggests they would be unlikely to move families to the area. Consequently, the total population effect from construction is expected to be negligible, as noted in **Table 3.10-8**.

Operations

Assuming most operations workers also would be local hires, as noted below, the total new population effect from operations workers and their families would be a maximum of approximately 216 persons during the peak year (2016) (**Table 3.10-9**). It is expected that most of these people would be located in western Elko County, where the increase would represent less than 1.0 percent of the 2010 population of Elko, Spring Creek, and Carlin (**Table 3.10-1**).

As noted above, it is uncertain how many of the workers needed for the proposed project would be new hires and how many would be transferred from other projects. It also is notable that the highest levels of employment for the proposed project would only last for approximately 2 years. Consequently, the population effects are likely to be less than the maximum. The estimated number of project employees would be at or above approximately 280 for 5 years from 2014 through 2018. A 5-year-long position would be more likely to induce a family to move than a 2-year-long position. At that level, the population increase would be approximately 160, which would be approximately 0.5 percent of the 2010 population of the three principal communities in western Elko County. In either case, the population effect of the proposed project would be expected to be modest.

Housing

Construction

Construction-related demand for housing is estimated at a very modest 10 units, assuming most construction workers would be hired from the local labor force. Even if the anticipated contractor workers were brought in from outside the study area, however, there is an ample supply of temporary housing resources available with more than 2,000 motel/hotel rooms, over 500 recreational vehicle spaces, and several campgrounds in the local area to accommodate them with no adverse effects on other local activities.

Operations

Operation of the proposed project would generate demand for an estimated 96 housing units for the peak 2 years of the project (**Table 3.10-9**). As noted above, over 2,100 housing units were vacant in Elko County in 2010 which, if it has continued to be reasonably accurate, would indicate there would be more than enough housing available to accommodate this level of demand. If current vacancy rates remain above 10 percent for rental units, an increase in housing demand would benefit that segment of the housing market, although the market for homeowner units remains very tight.

Community Facilities and Services

No significant capacity or service issues have been identified for public facilities or services in the two-county study area. In addition, underlying population growth rates have declined to modest levels in recent years. Consequently, the relatively small number of new people that would be anticipated for construction and operation of the proposed project, even under the maximum scenario, would not be expected to adversely affect public services in the area.

Education

School enrollment would increase by up to 40 students under the estimated maximum population growth scenario for operations at the proposed project (**Table 3.10-9**). Elko County school enrollment is currently more than 400 students below the level seen in the 2006-2007 school year, however, so the effects would be minor and would be well within the capacity of district schools (**Table 3.10-5**).

Public Finance

The proposed project would generate public revenues primarily from sales and use taxes and net proceeds of mines taxes. Sales taxes would be heavily front loaded as most major equipment purchases would take place during the first 2 years of the project. BDMV estimates the project would pay sales taxes of $1.4 million in 2013 and $0.8 million in 2014. Estimated sales taxes in subsequent years would range from $39,000 to $179,000 and would average approximately $105,000 per year. Total sales taxes over the 8 year project life are estimated at $2.8 million, divided among the state ($826.000), the school districts ($1,074,000), Elko County ($207,000) and the counties revenue sharing pool ($723,000).

Net proceeds taxes would be a more substantial contributor to public coffers in Elko County. BDMV estimates total net proceeds taxes from the proposed project at $34.8 million, ranging from $352,000 in 2013 to $9.8 million in 2020, although with considerable variation over the 8-year mine life. Net proceeds of mines are categorized and taxed like real property. As noted in **Table 3.10-6**, Elko County budgeted for property tax revenue of slightly over $10 million in FY 2009-2010. The estimated net proceeds tax for 2013 would constitute a modest 3.5 percent of that amount, but would range from 18 percent to 98 percent of that amount in subsequent years. Property taxes have been budgeted at approximately one-quarter of total general fund revenue for Elko County in recent years.

Social Conditions

With only a modest change in permanent employment and a minor increase, at most, in population expected from the proposed project, it is not expected to cause adverse changes in the social structure or traditional lifestyles of study area communities. A possible influx of a small number of contract workers, if it should occur, would be of short duration and would not noticeably affect the quality of life of people currently living in the area. The possible transfer of some workers to the proposed project from other projects in the region would potentially sustain the jobs of current employees for a few additional years, which would be expected to sustain their individual lifestyles, and modestly enhance the stability and social structure of the community as a whole. Extending the employment of those workers could be beneficial to the long-term sustainability of the community as it would provide additional time for local economic diversification efforts to be realized.

3.10.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance.

Under this alternative, the project would be delayed by an uncertain amount of time, and would increase costs to some degree. Employment levels, labor expenses, and most equipment and materials purchases would be the same as for the proposed project. Consequently, potential effects from this alternative on income and employment, population, housing, community facilities and services, education and social conditions would be expected to similar to the Proposed Action. There would be modest differences in the effects on public finance compared with the Proposed Action. Increased production costs would result in a reduction in net proceeds of mines taxes to Elko County over the life of the mine, as compared with the Proposed Action. The amount of the reduction would depend on the level increase in costs as the total amount of gold and silver produced would likely remain the same. There would also be potential changes in the schedule of tax payments of all types commensurate with the change in the schedule of development and production compared with the Proposed Action.

3.10.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would require the sequencing of mining to allow backfilling portions of the open pit with waste rock during mining. The mining sequence would be less flexible than under the Propose Action. Under this alternative, delays in the schedule would occur to adjust for transport of waste rock to the East and South pits. The mining rate would slow by an estimated 22 percent, resulting in a 1-year extension of the mine life. At the slower mining rate, nine fewer trucks and one fewer electric shovel would be utilized, compared with the Proposed Action.

Construction of the project would be the same as under the Proposed Action, beginning in 2013, lasting approximately 8 months, and employing approximately 90 contract workers and 10 BDMV workers. At completion of construction, operations would begin with a work force of approximately 103, 40 fewer than under the Proposed Action. As noted in **Table 3.10-10**, the total employment level would grow to a maximum of approximately 290 in 2017, and would taper down to approximately 103 in 2022. Approximately 15 workers would remain from 2023 through 2025 as closure and final reclamation activities are completed. It is expected that the project would terminate by 2026, except for long-term monitoring and fluid management activities.

As noted for the Proposed Action, there is a range of possible scenarios for how the employment would be implemented by BDMV (BDMV 2010f) (Section 3.10.2.1, Proposed Action).

Income and Employment

Construction

Construction effects would be the same as for the Proposed Action (**Table 3.10-8** and related text).

Table 3.10-10 Partial Pit Backfill Alternative Employment by Year

Employees/ Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Salaried	21	23	25	27	27	27	27	23	11	21	3
Hourly	82	133	191	220	263	236	223	129	117	82	12
Total Employees	103	156	216	247	290	263	250	152	128	103	15

Source: BDMV 2011.

Operations

Operations employment would start at 103 workers in 2013. It would grow to over 200 by 2015, peaking at 290 workers in 2017. It would decline progressively back to 103 in 2022 (**Table 3.10-10**). At the peak, the maximum employment effect would be approximately 505 workers, including indirect employment (**Table 3.10-11**). As under the Proposed Action, this level likely would be the maximum. As noted above, it is uncertain how many of the project employees would be new hires - which would theoretically generate indirect jobs based on the multiplier effect - as opposed to transferees from other local projects. If some or all of the jobs at the Arturo Mine Project were filled by transferees, the indirect employment they would support would already be included in the local economy and the effect would be one of sustaining existing economic activity rather than generating new activity. The maximum employment effects noted in **Table 3.10-11** would last for just 1 year. It is likely that indirect employment changes would not respond as quickly as direct employment, although much of the economic activity generated by worker expenditures would still occur.

Because there are approximately 2,300 unemployed in the two-county study area, it is assumed that most of the workers needed for the proposed project would be available locally. An estimated 80 workers from outside the local area would be needed in the peak year. The 2017 peak employment during operations would represent a 1.9 percent increase over total 2008 employment in the two-county study area. It would reduce the unemployment rate to approximately 6.3 percent, if all of the jobs were filled by new hires from the local area.

The employment effects would be proportionally less than those described for the peak year during earlier and later years of the proposed project.

The direct payroll for the Partial Pit Backfill Alternative would range from $8.7 million (2013, 2022) to $24.4 million (2017) and would total approximately $160.3 million during the 10-year operating life of the project. Each $1.00 in direct earnings would indirectly generate $0.37 in earnings to other workers in the local economy (BEA 1997; Dobra 1989; Price and Harris 2007). Consequently, the annual indirect earnings effect would range from $3.2 million to $9.0 million and the total combined effect would be $219.6 million during the operating life of the project. The increase in income earnings would be a substantial economic benefit accruing to the local economy. Although the peak employment level projected for the Partial Pit Backfill Alternative would be lower than for the Proposed Action, the total direct and combined payroll generated would be slightly higher because of the additional 1 year of operations.

Table 3.10-11 Partial Pit Backfill Alternative - New Operations-related Employment, Households, and Population Projections

New Operations-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
232	58	290	193	22	215	425	80	505

New Operations-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	58	22	--
Single	15	5	20
Married - 1 Worker	39	8	47
Married - 2 Workers	2	4	6
New Households	**56**	**17**	**73**

New Operations-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-age	Other	Total
Single Households	20	20	0	0	20
Married Households	53	106	30	8	144
Total	**73**	**126**	**30**	**8**	**164**

[1] Work force was assumed to be 80 percent local, 20 percent non-local.

[2] Indirect employment was calculated using an employment multiplier of 1.74; the indirect work force was assumed to be 90 percent local and 10 percent non-local.

[3] Direct work force was assumed to be 25 percent single or married without families present; 10 percent of the married worker households were assumed to be two-worker families.

[4] Indirect work force was assumed to be 25 percent single or married without families present; half the married worker households were assumed to be two-worker families.

[5] Population estimates were based on one person per single family household and 2.7 persons per married household.

[6] Eighty percent of children were assumed to be of school age.

Population

Construction

Population effects from construction under the Partial Pit Backfill Alternative would be the same as for the Proposed Action; they are expected to be negligible, as noted in **Table 3.10-8**.

Operations

Assuming most operations workers would be local hires, the total new population effect from operations workers and their families would be a maximum of approximately 164 persons during the peak year (2017) (**Table 3.10-11**). It is expected that most of these people would locate in western Elko County, where the increase would represent 0.5 percent of the 2010 population of Elko, Spring Creek, and Carlin (**Table 3.10-1**).

As explained previously, it is uncertain how many of the workers needed for the Partial Pit Backfill Alternative for the Arturo Mine Project would be new hires and how many would be transferred from other projects. Since the highest employment level for the Partial Pit Backfill Alternative would only occur in 1 year, the population effects are likely to be less than the maximum. The estimated number of employees would be at or above approximately 250 for 4 years from 2016 through 2019. A 4-year-long job would be more likely to induce a family to move than a 1-year job. At that level, the population increase would be approximately 140, which would be approximately 0.4 percent of the 2010 population of the three principal communities in western Elko County. In either case, the population effect of the Partial Pit Backfill Alternative would be expected to be modest.

Housing

Construction

Construction-related demand for housing would be the same as for the Proposed Action.

Operations

Operation of the Partial Pit Backfill Alternative would generate demand for an estimated 73 housing units for the peak year of the project (**Table 3.10-11**). As noted above, over 2,100 housing units were vacant in Elko County in 2010, which would indicate there would be more than enough housing available to accommodate this level of demand, although the market for homeowner units is extremely tight.

Community Facilities and Services

No significant capacity or service issues have been identified for public facilities or services in the two-county study area. The population generated demand under the Partial Pit Backfill Alternative would be somewhat less than under the Proposed Action and would not be expected to adversely affect public services in the area.

Education

School enrollment would increase by up to 30 students under the estimated maximum population growth scenario for operations under this alternative (**Table 3.10-11**). Elko County school enrollment is currently more than 400 students below the level seen in the 2006-2007 school year, however, so the effects would be minor and would be well within the capacity of district schools (**Table 3.10-5**).

Public Finance

The Partial Pit Backfill Alternative would generate public revenues in a similar fashion to the Proposed Action. Sales taxes generated by this alternative would be modestly lower than under the Proposed Action because 9 fewer trucks and 1 fewer electric shovel would be required. In addition, fuel requirements would be approximately 9 percent lower than for the Proposed Action which would reduce the sales tax for fuel by a comparable percentage.

The potential effect of the Partial Pit Backfill Alternative on net proceeds taxes is uncertain. It is assumed that the same amount of gold and other minerals would be produced. However, the effects on production costs, and thus net proceeds, are uncertain. Labor costs are estimated to be slightly higher; but equipment and fuel costs are estimated to be modestly lower.

Long-term effects - beyond the proposed life of the Arturo Mine Project - may be negative depending on the potential value of the mineral resources "sterilized" by partially backfilling the pits.

Social Conditions

With only a modest change in permanent employment and a minor increase in population expected from the Partial Pit Backfill Alternative - slightly smaller than for the Proposed Action - it is not expected to cause adverse changes in the social structure or traditional lifestyles of study area communities. Effects would be similar to those from the Proposed Action.

3.10.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential effects on social and economic conditions would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, ongoing mineral exploration activities, and reclamation within the study area, would be conducted under existing authorizations. No additional employment or production beyond those currently authorized would occur at the mine site.

Under the No Action Alternative, the project area would ultimately enter into a post-closure period of care and maintenance to support the long-term land use goals, which include recreation, mineral exploration, wildlife management, and grazing. This post closure period would include maintenance of storm water management facilities and long-term water, stability, and vegetation monitoring. Employment and payroll for these activities would be very minor. There would be a small amount of sales tax generated from the purchase of material and supplies needed to support the activity. There would be no new net proceeds of mines taxes generated.

There would be no additional demands for housing, community facilities and services, or education resources. With such small numbers of employees for post closure activities, there would be no measurable effect on social conditions in the study area.

3.10.3 Cumulative Impacts

The CESA for social and economic values is defined in Section 3.10.1, Affected Environment, and is shown in **Figure 3.10-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.10.3.1 Proposed Action

Social and economic effects of past, present, and RFFAs are reflected in the affected environment information presented in Section 3.10.1, Affected Environment. As a result, any potential cumulative effects for past, present, and RFFAs are included in the discussion of environmental consequences in Section 3.10.2, Environmental Consequences.

Employment from mining activity in the Carlin Trend is a major contributor to economic activity in the CESA. Most of the work force associated with this employment and related mining support activities resides in the Elko Micropolitan Statistical Area (MSA). **Table 3.10-12** lists past, existing actual, and projected employment for the major projects in the Carlin Trend along with the portion of that employment that resides in the Elko MSA. As noted above, the proposed project could expand employment by a relatively small amount; it could extend employment for workers transferred from other projects by several years; or some combination of the two. Regardless of the exact scenario that would transpire, the proposed project would represent a relatively modest portion of the total mining related employment in the area. As illustrated in the table, employment from the major projects in the Carlin Trend is projected to decline after 2012 without the proposed project. The Proposed Action would offset

Table 3.10-12 Actual and Projected Employment for Residents of Elko MSA at Mine Facilities in Carlin Trend and TS Power Plant

	Year of Operation																	
	2001		2007		2008		2009		2010		2013		2015		2020		2025	
Mine	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA
Newmont Carlin Trend (less Midas with Genesis)	1,455	1,455	1,907	1,907	2,374	2,374	2,289	2,289	2,061	2,061	2,011	2,011	1,722	1,722	788	788	71	71
Barrick Betze Pit	1,127	1,082	1,131	1,082	597	573	597	573	601	577	599	575	333	320	114	109	14	13
Barrick Meikle	607	583	919	882	526	505	526	505	548	526	603	579	450	432	0	0	0	0
Barrick Overhead and Processing	IA	IA	IA	IA	549	527	549	527	336	323	329	316	289	277	218	207	162	155
Barrick Contractor Employees	IA	IA	IA	IA	400	384	400	384	400	384	400	384	400	384	200	192	75	72
Barrick Cortez	394	299	550	418	985	749	885	673	885	673	885	673	685	521	155	118	0	0
Newmont Midas	233	0	220	0	225	0	225	0	202	4	171	0	0	0	0	0	0	0
Rodeo Creek Gold (RCG) Hollister Existing and Proposed	0	0	144	10	144	10	144	10	216	15	216	15	216	15	216	15	216	15
RCG Hollister Contractors	0	0	0	0	0	0	0	0	0	0	150	10	0	0	0	0	0	0

Table 3.10-12 Actual and Projected Employment for Residents of Elko MSA at Mine Facilities in Carlin Trend and TS Power Plant

Mine	Year of Operation																	
	2001		2007		2008		2009		2010		2013		2015		2020		2025	
	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA	Total	Elko MSA
Barrick Bald Mountain	107	68	196	125	205	131	285	179	295	186	325	208	260	166	25	16	0	0
Jerritt Canyon	411	370	357	321	400	360	30	27	150	135	Unk		Unk		Unk		Unk	
TS Power Plant	0	0	UC	UC			65	46	65	46	65	46	65	46	65	46	65	46
Arturo Proposed	0	0	0	0	0	0	0	0	0	0	153	153	358	358	50	50	0	0
Arturo Proposed Contractor	0	0	0	0	0	0	0	0	0	0	90	90	0	0	0	0	0	0
Totals with Proposed Arturo	4,334	3,857	5,424	4,745	6,405	5,613	5,995	5,213	5,759	4,930	5,997	5,060	4,778	4,241	1,831	1,541	603	372
Totals without Proposed Arturo	4,334	3,857	5,424	4,745	6,405	5,613	5,995	5,213	5,759	4,930	5,754	4,817	4,420	3,883	1,781	1,491	603	0
Net Due to Proposed Arturo	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	243	243	358	358	50	50	0	0

NA = Not Applicable; IA = Included above; Unk = Unknown; UC = Under construction for 27 months with employment at a maximum of 900 workers - most from out of the area.

Elko MSA = Encompasses Elko, Spring Creek, Carlin, and the adjacent unincorporated communities in Elko County, Nevada.

Source: BLM 2010a,b.

that decline to some degree through 2020. Employment from the Proposed Action would provide income for the work force, which would generate indirect and induced economic activity through the life of the project, offsetting potential declines from other major projects to a modest degree.

In addition to the cumulative employment effects, the Proposed Action would contribute to the tax revenues of Elko and Eureka counties and the cities of Elko and Carlin. The cities would benefit primarily from sales tax revenues. Elko County would receive revenues from net proceeds taxes and other ad valorem taxes from both the project itself and from related properties as well as from sales taxes. Eureka County would benefit modestly from taxes generated by secondary economic activity; other major projects contribute substantially more to Eureka County.

3.10.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects of the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action.

3.10.3.3 Partial Pit Backfill Alternative

Cumulative effects of the Partial Pit Backfill Alternative would be similar to cumulative effects associated with the Proposed Action, except that the employment, income, and public revenue generated by this alternative would be somewhat lower, but would extend for approximately an additional 1 year.

3.10.3.4 No Action Alternative

Under the No Action Alternative, the post closure period of care and maintenance to support the long-term land use goals would require a very small work force. This post closure-period would include maintenance of storm water management facilities and long-term water, stability, and vegetation monitoring. Employment and payroll for these activities would be very a small increment of the total mining related economic activity in the CESA and an even smaller increment of the total economic activity in the CESA. There would be a small amount of sales tax generated from purchase of material and supplies needed to support the activity. There would be no new net proceeds of mines taxes generated from the proposed project. There would be no project-related demands for housing, community facilities and services, or education resources. With such a low level of economic activity for post closure activities, the cumulative effects would be virtually undetectable in the economy of the CESA.

3.10.4 Potential Monitoring and Mitigation Measures

No monitoring or mitigation measures for social or economic values effects are recommended.

3.10.5 Residual Impacts

For the most part, social and economic effects from the proposed project would end after the project is completed. There would be public and private investment in infrastructure, homes, and businesses from revenues generated by the project that would have economic life beyond the life of the project. The minerals produced by the proposed project also would continue to have value after the project is completed.

3.11 Recreation and Wilderness

3.11.1 Affected Environment

The study area for recreation consists of the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occur outside of the proposed PoO boundary; and public lands within approximately 10 miles of the proposed project. The Cumulative Effects Study Area (CESA) for recreation includes western Elko County and the northern portions of Eureka and Lander counties (**Figure 3.11-1**). The study area and CESA for wilderness includes the proposed project and an area within a radius of approximately 50 miles of the study area. The CESA is based on the area within proximity of the project area where most workers and their families are likely to live and recreate and where the proposed project and past, present, and reasonably foreseeable future actions (RFFAs) might be expected to jointly affect recreational opportunities or wilderness areas.

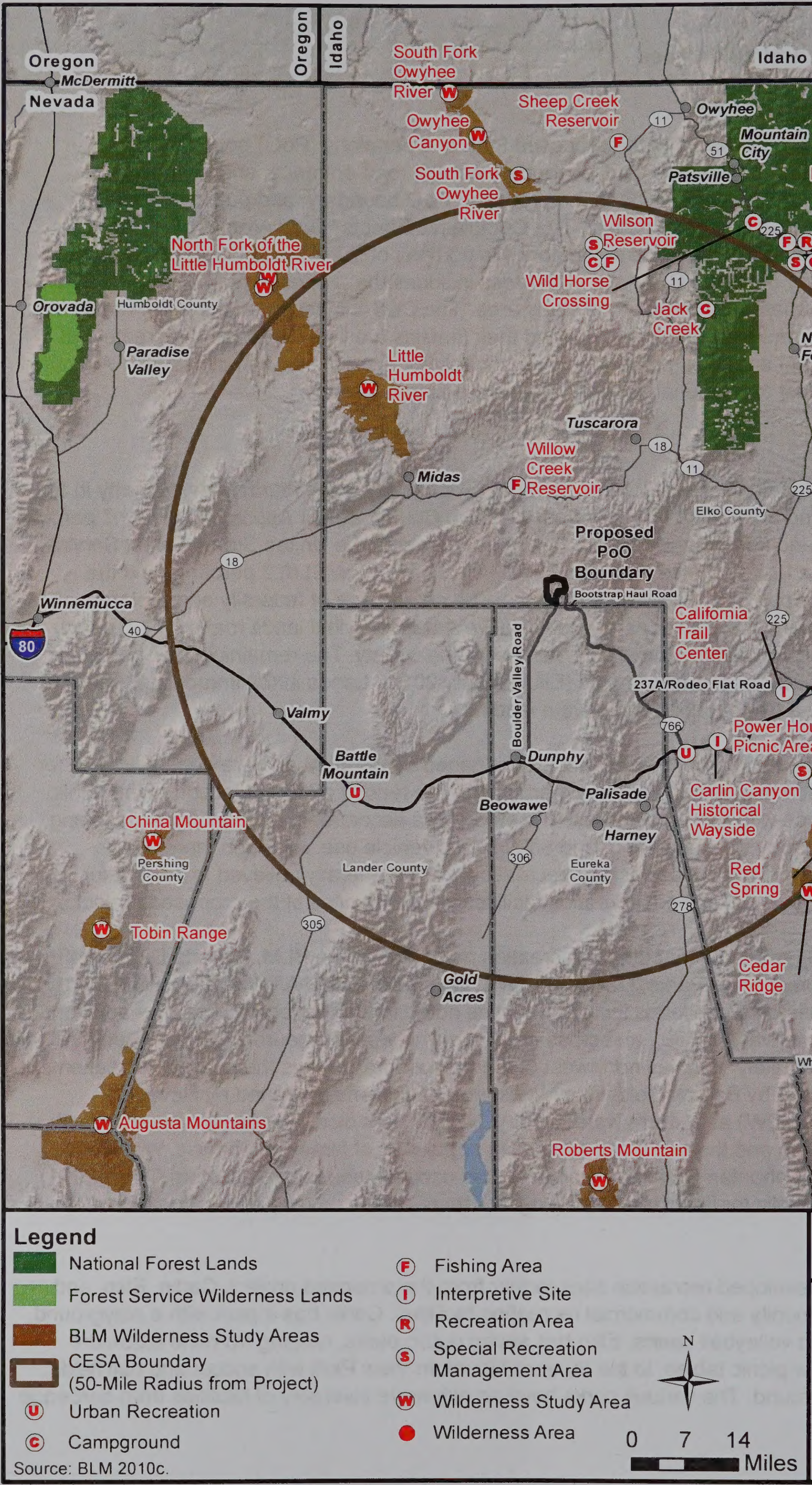
3.11.1.1 Recreation

The proposed project is located in Elko County, Nevada. Elko County is the fourth largest county in the lower 48 states with a land area of 17,181 square miles (Elko County 2010). Approximately 72.7 percent of the county is federal land administered by the BLM (62.6 percent), the United States Forest Service (USFS) (9.8 percent), the United States Fish and Wildlife Service (USFWS) (0.2 percent), and the Defense Department (0.1 percent). Although substantial, the percentage of federally administered lands is less than the 86.5 percent of the state as a whole. Native American tribal lands make up 1.5 percent of the county and the state owns approximately 0.1 percent of the county. The remaining 25.7 percent is privately owned or owned by local governments (Elko County 2010). Lands in the immediate vicinity of the proposed project are a mix of public and private lands.

Public lands in the vicinity of the proposed project are managed by the BLM and are generally open for dispersed public recreation use, except for mining areas that are fenced off for protection of the public and to prevent interference with mining activities. The study area accommodates hunting, sightseeing, mountain biking, photography, rockhounding, and off-highway vehicle use. Although there are no statistics on recreation use in the project vicinity, recreation use is generally believed to be light for all of these activities. There are no developed recreation facilities within 10 miles of the proposed project.

The CESA includes lands available for outdoor recreation managed by the BLM, Nevada Division of Forestry, Nevada Division of State Parks, USFS, USFWS, Bureau of Indian Affairs, and private land owners. Recreational uses on these lands include the uses noted for the project vicinity, plus additional uses such as fishing, white water rafting, and cross-country skiing where resources support them. Willow Creek Reservoir, approximately 15 miles northwest of the proposed project, is the nearest recreation site. The reservoir is owned by Barrick Goldstrike Mines Inc. (BGMI) and managed by Nevada Department of Wildlife (NDOW) as a warm water fishery. NDOW periodically stocks the reservoir with crappie and channel catfish and there is a self-sustaining population of large-mouth bass. When flow conditions are favorable, Lahontan Cutthroat Trout also can occur in the reservoir system (Miller 2011). The area is open to the public for fishing and camping, but there are no developed facilities at the reservoir.

There are a number of developed recreation sites farther from the proposed project. Carlin, Elko, and Spring Creek have community and commercial recreation facilities. Carlin has a park with a playground, ball fields, and tennis and volleyball courts. Elko has seven public parks, ranging from the 0.25-acre Greenbelt Park with a few picnic tables, to the 30-acre Mountain View Park with soccer and ball fields, picnic shelter, and playground. The various parks have an extensive inventory of facilities from barbeque



Source: BLM 2010c.

05/16/2012

Arturo Mine Project EIS

Figure 3.11-1

Recreation and Wilderness Cumulative Effects Study Area pits and playgrounds to tennis courts and ball fields. Elko also has an 18-hole golf course (Ruby View) and a Municipal Swimming Pool, with both indoor and outdoor pools. The city also provides numerous recreation programs, including ski and snowboard youth programs at the Elko Snobowl Ski Area approximately 6 miles north of town. Spring Creek has an 18-hole golf course, a trap and skeet shooting range, a campground, a sports complex, and a horse palace. There are two private homeowners' parks in Spring Creek as well.

The South Fork State Recreation Area (SRA), approximately 40 miles southeast of the project site, has a boat ramp and campground with restroom and shower facilities. The SRA is adjacent to a BLM Special Recreation Management Area (SRMA). The Wild Horse SRA is approximately 50 miles northeast of the proposed project on the northeast shore of Wild Horse Reservoir. The Wild Horse SRA has facilities similar to the South Fork SRA. Both SRAs provide opportunities for dispersed recreation activities in addition to the developed facilities.

Developed USFS recreation facilities in the area are limited to campgrounds with non-flush type toilet facilities. The Jack Creek campground and Wild Horse Crossing campground are approximately 40 and 50 miles, respectively, northeast of the proposed project. Both campground facilities are in the Mountain City Ranger District of the Humboldt-Toiyabe National Forest and provide access to multiple dispersed recreation opportunities in addition to camping.

There are five BLM SRMAs within approximately 50 miles of the proposed project. The nearest SRMA, South Fork Canyon SRMA, is approximately 40 miles southeast of the project site and has no developed facilities. It is a popular put-in spot for rafting through walled canyons of the South Fork Humboldt River. Wilson Reservoir SRMA is approximately 45 miles north of the project site; the area is developed with a boat ramp, campground, and restrooms. South Fork Owyhee River, Wild Horse and Zunino/Jiggs Reservoir SRMAs are all approximately 50 miles from the proposed project. South Fork Owyhee River to the north is not developed, but includes a river corridor eligible for Wild and Scenic River designation. Wild Horse SRMA to the northeast has a campground with restroom facilities and adjoins the Wild Horse SRA, which has additional facilities as noted above. Zunino/Jiggs Reservoir SRMA, southeast of the site, has a campground, restrooms, and picnic facilities.

The California Trail interpretive center is scheduled to open in June 2012 at the Hunter exit from Interstate 80, approximately 8 miles west of Elko. The center hosts programs and exhibits related to the historic California Trail, which was used from 1841 through 1868. The trail ran along the same corridor as the present day interstate highway, paralleling the Humboldt River.

3.11.1.2 Wilderness

In 1979, 130 acres of the project area was evaluated for wilderness characteristics. The Inventory Unit polygons identified and inventoried in 1979 are: NV-010-123, Bootstrap; NV-010-124, Antelope Creek; NV-010-210, Checkerboard; and NV-010-211, Wilson.

At that time it was determined that the project area and adjacent surrounding areas did not meet the criteria for wilderness characteristics or designation for wilderness because:

- NV-010-123, Bootstrap. Reason: The unit does not meet the basic requirements necessary to be carried over to the intensive inventory stage. Due to lack of topographic and vegetative screening, and the relatively small size, it lacks outstanding opportunities for solitude or a primitive and unconfined type of recreation in comparison to others of its kind.
- NV-010-124, Antelope Creek. Reason: This area has already been intensively inventoried because of a special project. The intensive inventory found that the area lacked wilderness characteristics and it was dropped from further wilderness consideration.

- NV-010-210, Checkerboard. Reason: None of the public lands, other than a few acres described elsewhere, occur in blocks of more than 5,000 acres each. In fact, most are the size of a single section (640 acres). None of these lands are in areas of sufficient size as to make practicable its preservation and use in an unimpaired condition.
- NV-010-211, Wilson. Reason: None of the public land in the blocks of less than 5,000 acres are of sufficient size as to make practicable its preservation and use in an unimpaired condition.

Considering the 1979 inventory and subsequent disturbance, the Elko District management has determined that the area does not contain lands with wilderness characteristics.

In November 1980, the final inventory decision was made for most Wilderness Study Areas (WSAs) in Nevada. A total of 103 WSAs were identified and analyzed through the wilderness inventory. In October 1991, the BLM Nevada State Office released the Nevada BLM Statewide Wilderness Report (BLM 1991c) documenting the rationale and recommendations for the WSAs. The criteria considered in developing the wilderness recommendations included naturalness, solitude, primitive and unconfined recreation, and special features. The report recommended wilderness designation of 1.9 million acres within 52 of the WSAs and release of 3.2 million acres from WSA management. The President sent the report to Congress in 1992. Congress passed the Black Rock Desert – High Rock Canyon Emigrant Trails National Conservation Area Act in December 2000, which designated 10 new wilderness areas, primarily in the northwest corner of Nevada (BLM 2004b). There also have been subsequent actions in Lincoln and Clark counties, but to date, none of the WSAs within 50 miles of the proposed project have been addressed.

There are no designated wilderness areas within 50 miles of the proposed project. The nearest is the Ruby Mountains Wilderness, a 93,000-acre area approximately 60 miles southeast of the proposed project spread out along the crest of the Ruby Mountains. The area has 10 peaks over 10,000 feet above mean sea level, numerous alpine lakes, a large mule deer herd, elk, mountain goats, bighorn sheep, and trout streams. The Ruby Crest National Recreation Trail traverses through the wilderness for 40 miles.

The Jarbidge Wilderness Area is located approximately 75 miles northeast of the proposed project. Jarbidge is the second largest wilderness area in Nevada at over 113,000 acres. It has more than 100 miles of trails. Lakes in the area are reputed to provide excellent fishing opportunities and elk hunting is an attraction. The Jarbidge Wilderness area is one of the most remote places in the country.

Three WSAs are located within a 50-mile radius of the proposed project: the Cedar Ridge WSA, the Little Humboldt River WSA, and the Red Spring WSA (**Figure 3.11-1**). The Cedar Ridge and Red Spring WSAs were identified as "not suitable" for wilderness designation; approximately 70 percent of the Little Humboldt River WSA was identified as "suitable" for designation (BLM 2010e).

The Cedar Ridge WSA (NV-010-088) encompasses 10,009 acres. It is located approximately 50 miles southeast of the proposed project. It has high woodland product values, high potential for oil and gas, and moderate potential for precious metals, uranium, and barite. Wilderness values are present, but not considered outstanding and management for wilderness would be difficult. Other values were considered more important than wilderness values in this WSA and the entire acreage was recommended for release from wilderness consideration.

The Little Humboldt River WSA (NV-010-132) is located approximately 35 miles northwest of the proposed project. The entire area includes 42,213 acres; it contains 2 privately owned in-holdings of 40 acres and 160 acres. Wilderness designation was recommended for 29,775 acres of the WSA because it contains "diverse ecosystems with high wilderness values." Terrain varies from deep canyons to mesas and high rocky ridges to wide plains. Numerous wildlife species are found in the area. Recreation opportunities include photography, hunting, fishing, camping, hiking, horseback riding, rock climbing, and wild horse viewing (BLM 2010e). The area is natural appearing, has "outstanding" opportunities for both solitude and primitive and unconfined recreation.

The 7,847-acre Red Spring WSA (NV-010-091) is located approximately 45 miles southeast of the proposed project. It has high value woodland products, high potential for oil and gas, and moderate potential for uranium and barite. Wilderness values in this area are not considered outstanding and are limited to small areas of the WSA. Consequently, management for wilderness would be difficult, and the entire acreage was recommended for release from wilderness consideration.

3.11.2 Environmental Consequences

Primary issues related to recreation include displacement of dispersed recreational opportunities primarily related to hunting and off-road vehicle use and changes in recreation demand within the study area. Primary issues related to wilderness include whether the permitted action would be in compliance with the Wilderness Act of 1964 and the BLM Interim Wilderness Management Policy.

The proposed project or alternatives potentially could affect recreation and wilderness resources both directly and indirectly. Direct impacts may include elimination or displacement of recreation resources in the project area, or degradation of the recreation experience for users of the resources due to noise, traffic, excessive dust, or other emissions from the proposed project. Indirect impacts may result from changes in demand for limited recreation resources as a result of project-related population change.

3.11.2.1 Proposed Action

Recreation

The project area encompasses a total of approximately 3,627 acres, of which 3,551 acres (98 percent) are public lands administered by the BLM. Approximately 76 acres (2 percent) are private lands. Proposed project activities on private lands include approximately 0.9 mile of rerouted utility corridor, the construction of a new electrical substation, and approximately 106 acres devoted to widening the existing Bootstrap Haul Road, which is outside the proposed PoO boundary. As currently planned, total surface disturbance would be approximately 2,774 acres; of which 2,703 acres would be on public land. The proposed project would add approximately 1,962 acres to the existing or reclaimed disturbance of 812 acres – an increase of approximately 240 percent (see **Table 2-2**). Selected ore from the project would be hauled by truck from the mine site to the BGMI facility via the Bootstrap Haul Road.

The proposed disturbance areas would be removed from public access for recreation purposes for the life of the project. However, most of this disturbed area receives very little recreational use at the present time due to its location and ongoing mining activity in the area. Also, there is extensive public land in the immediately surrounding area that would accommodate migration of dispersed recreation activity from the proposed project area. An example of the likely movement of activity to surrounding areas during the life of the proposed project is mule deer hunting, which is one of the most popular recreation activities in the project vicinity. During the initial development phase, it is likely that mule deer would move away from new areas of project activity and noise (Section 3.17, Wildlife and Aquatic Biological Resources). As a result, hunters would follow the game and hunt in areas nearby, but not immediately adjacent to the project area. Potential effects on most game species are anticipated to be low, although cumulative effects of area projects on mule deer migration would be high. However, the overall effect on recreational hunting would be minor.

Upon completion of mining, ore processing, closure, and reclamation, approximately 601 acres of disturbed land associated with the open pit would remain unreclaimed (a 472-acre increase in open-pit disturbance over the existing 129 acres previously disturbed by the existing open pit), but 2,173 reclaimed acres would be available for dispersed recreation use (Section 2.3.8, Closure and Reclamation Plan). After successful revegetation of disturbed areas, they would be expected to provide habitat for wildlife and offer hunting opportunities to hunters. The 601 acres that would not be reclaimed eventually would contain three pit lakes that may attract waterfowl, but the lakes would take as long as 100 to 300 years to form and even then access would be discouraged and very difficult so waterfowl hunting would be unlikely.

There may be a very modest increase in regional population resulting from the proposed project (Section 3.10, Social and Economic Values). New residents would increase the demand for recreation resources and opportunities in the region, but the increase would be small in the context of the existing population base. There is ample public land in the region to accommodate dispersed recreation needs of any expected population increase. Any adverse effects would be greatest at parks and other developed recreation facilities in the communities where the population increment would reside, primarily Elko, Carlin, and possibly Spring Creek. Such effects would be expected to be minor considering the recreation facilities available in the communities.

Because there is an ample supply of alternative land for dispersed recreation activities in the project vicinity, and because no unique recreation resources would be impacted as a result of the proposed project, effects on recreation resources would be considered minor.

Wilderness

There would be no direct effects, or measurable indirect effects (e.g., air quality) (Section 3.8, Air Quality), from the proposed project on wilderness areas. The proposed project would conform to the Wilderness Act of 1964 and the BLM Interim Wilderness Management Policy.

Based on the analysis, the effects of the proposed project on recreation and wilderness resources in the study area would be considered minor.

3.11.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. There would be no differences in the effects on recreation opportunities to the public as the changes associated with this alternative would occur within the same fenced perimeter as the Proposed Action. All other direct and indirect impacts associated with this alternative would be the same as described for the Proposed Action.

There would be no direct effects, or measurable indirect effects, from the Single WRDF Alternative on wilderness areas or WSAs.

3.11.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would have a similar footprint as the Proposed Action. Design height and capacity of the West and East WRDF would be significantly different compared to the Proposed Action. The West WRDF would be 230 feet lower and the East WRDF would be 310 feet higher under this alternative and the number of pit lakes would reduce from three to one. Mining would be sequenced differently from the Proposed Action to allow backfilling portions of the open pit with waste rock during operations. Under this alternative, delays in the schedule would occur to adjust for transport of waste rock to the East and South pits. The mining rate would slow by an estimated 22 percent, resulting in a 1-year extension of the mine life.

There would be no notable differences in the effects on recreation opportunities to the public during the life of the mine as the distinguishing differences from the Proposed Action would occur within the same fenced perimeter. There would be approximately a 1-year delay in completing reclamation and returning the reclaimed areas to public access for recreation use. This would be a minor effect in the context of the life of the Arturo Mine Project and the long-term availability of the area after project completion.

There would be no direct effects, or measurable indirect effects, on wilderness areas or WSAs from development of the Partial Pit Backfill Alternative.

3.11.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to recreation would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, ongoing mineral exploration activities, and reclamation within the study area, would be conducted under existing authorizations. No additional ground-disturbing activities beyond those currently authorized would occur at the mine site.

Recreation

Effects of the existing activities at the Dee Gold Mine were addressed in prior environmental analyses. Under the No Action Alternative, previous approvals include 543 acres that have been previously disturbed and reclaimed and 269 acres that remain disturbed. Some of the existing disturbance would be reclaimed when the Storm Underground Mine ceases operation in the future. These activities would have minimal, if any, effect on dispersed recreation opportunities in the project vicinity. The proposed project would not be developed and project-related temporary displacement of dispersed recreation would not occur.

Wilderness

Under the No Action Alternative, there would be no direct effects on any of the three WSAs in the CESA. The No Action Alternative would conform to the Wilderness Act of 1964 and the BLM Interim Wilderness Management Policy.

3.11.3 Cumulative Impacts

The CESA for access and land use is defined in Section 3.11.1, Affected Environment, and is shown in **Figure 3.11-1**. Past, present, and RFFAs are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs for mining activities are identified in **Table 3.2-1**; their locations are shown in **Figure 3.2-1** and **3.2-2**.

3.11.3.1 Proposed Action

Recreation

Past, present, and RFFAs within the CESA have resulted, or would result, in approximately 42,092 acres of mine-related surface disturbance as presented in **Table 3.2-1**. Past, present, and RFFAs from utility and energy development (Ruby Pipeline, North Elko Pipeline, TS Power Plant, and the Tuscarora Geothermal Power Plant) have resulted, or would result, in up to 3,210 acres of additional disturbance for a total cumulative disturbance of 45,302 acres. The proposed project disturbance of 2,774 acres represents approximately 6 percent of the total past, present, and RFFAs disturbance. The proposed project-related disturbance would be slightly more than 3 square miles, which would be a small increment of the vast acreage of public lands in the region, and would have minimal effect on existing or potential recreation activities in the CESA. The cumulative unreclaimed disturbance area that would remain after completion of the interrelated actions, including the pit areas of the proposed project, would be a small percentage of the total land area in the CESA, and would have a negligible long-term effect on recreation activities.

Foreseeable improvements in range and habitat restoration would be expected to improve the availability of forage for both wildlife and domestic animals in the CESA, partially offsetting the losses of grazing land from mineral development, which also would reduce any adverse effects on big game hunting opportunities.

Wilderness

The proposed project and alternatives would not have direct or measurable indirect effects on wilderness areas or WSAs. Therefore, there would be no cumulative impacts to Wilderness Areas or WSAs.

3.11.3.2 Single Waste Rock Disposal Facility Alternative

The cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action.

3.11.3.1 Partial Pit Backfill Alternative

The cumulative recreation and wilderness effects under the Partial Pit Backfill Alternative would be similar to the cumulative effects associated with the Proposed Action.

3.11.3.2 No Action Alternative

Recreation

Under the No Action Alternative, past and present actions would continue as approved and RFFAs would be evaluated prior to approval. Effects of the No Action Alternative on recreation resources and opportunities have been addressed in prior environmental analyses of past and present actions and the effects of RFFAs would be addressed in the applicable future analyses. Failing to approve the proposed project would not alter those effects so there would be no cumulative effects on recreation from the No Action Alternative.

Wilderness

Under the No Action Alternative, there would be no direct effects on any of the three WSAs in the CESA. Consequently, there would be no cumulative effects on wilderness that could be distinguished from those addressed in prior environmental analyses or to be addressed in future analyses of past and present actions and RFFAs.

3.11.4 Potential Monitoring and Mitigation Measures

No additional monitoring or mitigation measures are recommended for recreation or wilderness.

3.11.5 Residual Impacts

Residual impacts to land use would include the permanent loss of 472 acres of wildlife habitat and multiple use lands available for recreation from the expansion of the open pit, which would not be reclaimed. Consequently, this area would not support grazing by terrestrial wildlife, or other recreation uses common to the surrounding area. Three modest sized pit lakes would support water fowl, which may attract some recreational use, although safety barriers would discourage, if not completely prevent, access by the public.

3.12 Visual Resources

3.12.1 Affected Environment

The study area for visual resources encompasses the proposed project as seen from the five key observation points (KOPs) identified for the project. The Cumulative Effects Study Area (CESA) encompasses the viewshed of the proposed project (**Figure 3.12-1**). Due to the location of the project on exposed landforms, and related potential for extensive visibility, the CESA is defined by the broad viewshed area within 15 miles of the proposed project.

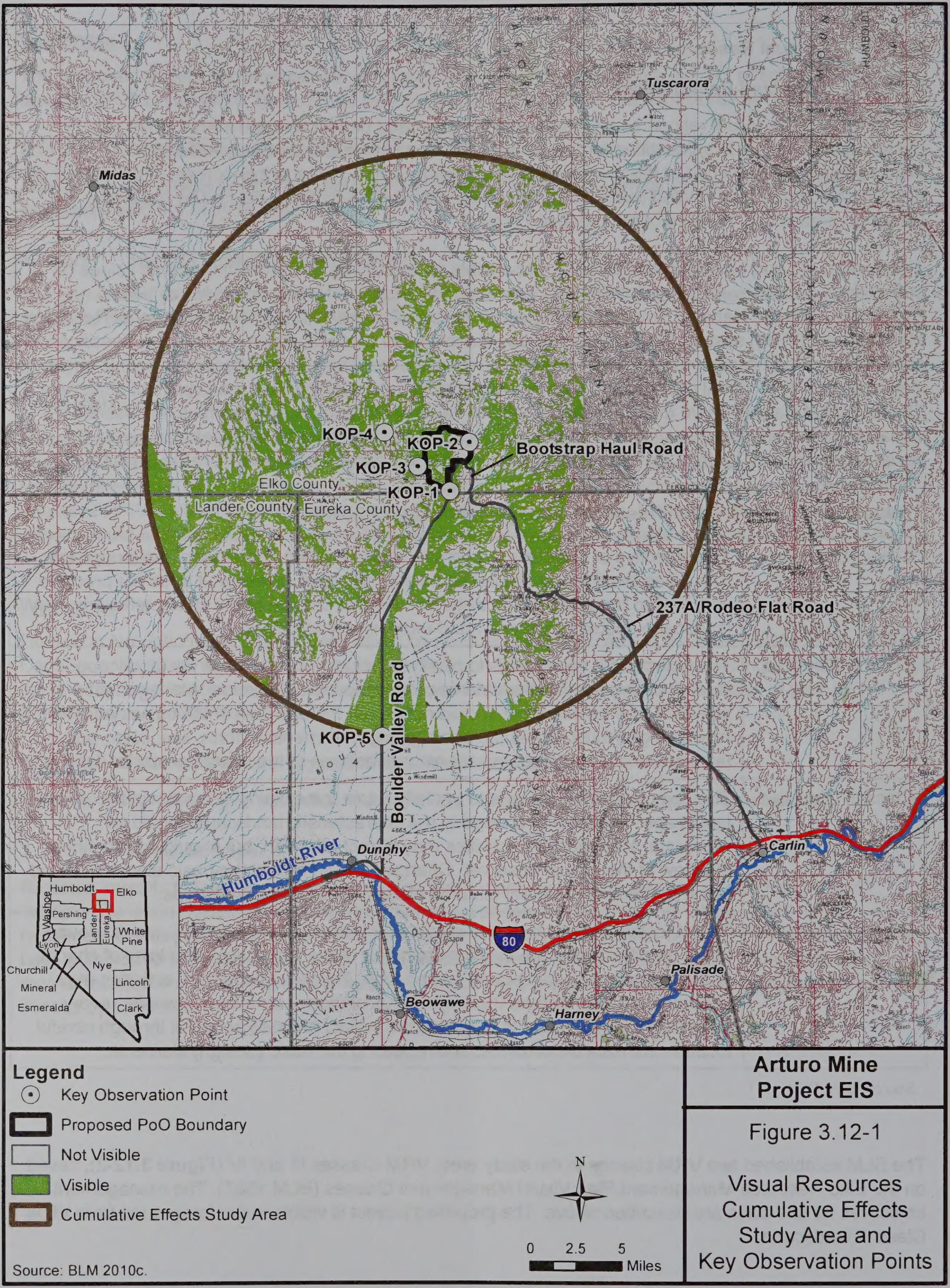
The Bureau of Land Management (BLM) is responsible for identifying and protecting scenic values on public lands under several provisions of the Federal Land Policy and Management Act of 1976 (BLM 2001) and the National Environmental Policy Act (U.S. Congress 1969). The BLM Visual Resource Management (VRM) system (BLM 1984) includes the inventory process, which leads to the classification of public lands and assignment of visual management objectives. This process considers scenic quality, viewer sensitivity to visual change, and viewing distances in determining visual management objectives. The four VRM classes serve to document the relative value of existing visual resources, to describe visual management objectives for land planning and establish thresholds for allowable change to the visual environment. The management objectives of the VRM classes are shown in **Table 3.12-1**.

Table 3.12-1 BLM Visual Resource Management Class Objectives

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic (design) elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities, which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic (design) elements.

Source: BLM 1984.

The BLM established two VRM classes in the study area; VRM Classes III and IV (**Figure 3.12-2**), based on the Elko Resource Management Plan Visual Management Classes (BLM 1987). The management objectives for this class are described above. The proposed project is visible in the foreground from VRM Class III landscape.



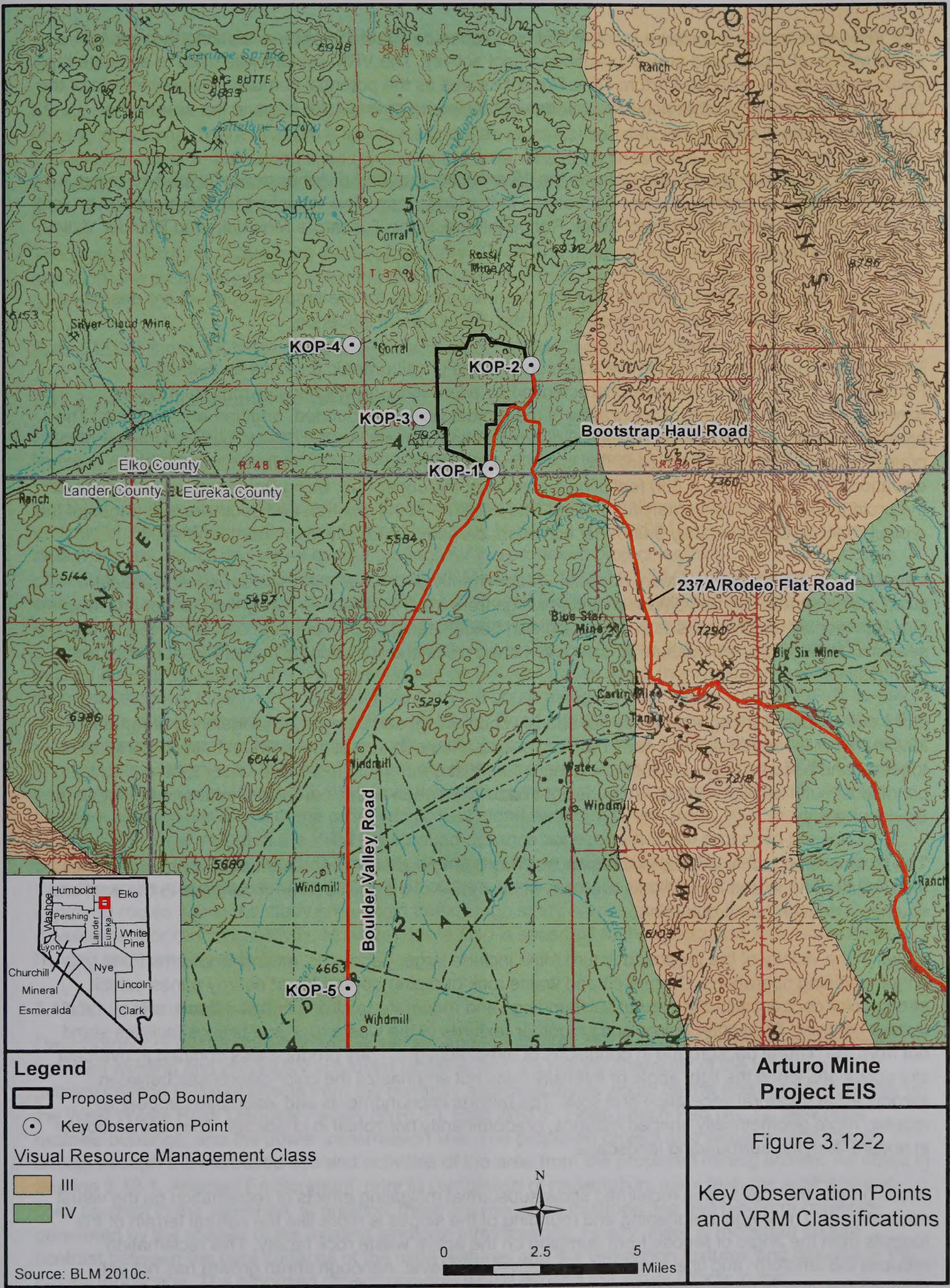
Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.12-1

Visual Resources Cumulative Effects Study Area and Key Observation Points

05/31/2012



Arturo Mine Project EIS

Figure 3.12-2

Key Observation Points and VRM Classifications

Source: BLM 2010c.

05/24/2012

The VRM system also includes a "contrast rating" procedure (BLM 1984) for evaluating the potential visual effects of a proposed project or management activity. The VRM system was used to evaluate the visual impact of the proposed Arturo Mine Project as well as the potential cumulative visual effects of the project in the context of other activities that have taken place or may take place in the area in the reasonably foreseeable future.

The extent of the viewshed is based upon the 15 miles background distance zone; beyond 15 miles, it becomes difficult to distinguish specific features in the landscape. The viewshed for the proposed project contains the area where the Sheep Creek Range intersects the Tuscarora Mountain and Boulder Valley (**Figure 3.12-1**).

Landscape characteristics contributing to the inventory process for the proposed project are described below, followed by VRM class designations for the visual area of influence.

The proposed project is located in the Basin and Range physiographic province as defined by Fenneman (1931). The province is characterized by alternating valleys and low mountain ridges common to northern Nevada. Topography of the project vicinity is rounded, angular, and irregular. The prominent landform in the project area is Round Mountain across Boulder Creek to the southeast of the project area, at 5,900 feet elevation. The lower end of the Boulder Valley, at the Humboldt River, is at an elevation of approximately 4,630 feet. The elevation of the upper end, along Boulder Creek adjacent to the project area, is approximately 5,300 feet. The ridgeline at the western and southwestern edges of the project reaches approximately 6,000 feet elevation, dropping gradually to the north and south.

Vegetation in the project boundary consists predominantly of grasses, with sparse, small to medium sized mixed shrubs. Shrub vegetation colors range from silvery gray-green to light and medium olive. Grasses display brighter greens in the spring with beiges, tans, and muted gold during the rest of the seasons. Native soils are medium to dark browns with rock outcrops adding muted tans, browns, and oranges.

Color differences, although generally not sharply contrasting, can be easily distinguished at ranges of less than 1 mile, especially with early morning or late afternoon sun at the viewer's back. Colors blend together and become very subtle or undistinguishable at greater distances and under different light conditions, such as high mid-day sun, the light haze often seen in this part of Nevada, and the fog in the Boulder Valley.

The proposed project is located in a region that has been mined for over a century. Two nearby mines, the Bootstrap Mine and Rossi Mine, are both within 1 mile of the project. The mountains to the east and southeast contain numerous mines.

Views in the vicinity of the proposed Arturo Mine include large, geometric, mining landforms from ongoing mining operations. Current pit and waste rock dumping operations at nearby mines exhibit strong color contrast with the natural surroundings and moderate to strong line, landform, and surface texture contrast. The lighter colors and smoother textures of the waste rock and tailings facilities stand out from the natural background in conditions of direct sunlight. They produce less contrast in overcast sky conditions when the light angle or intensity does not emphasize the color differences between introduced and natural vegetation and soils. The tailings impoundments and leach pads appear as regular, more geometrically shaped mounds, predominantly horizontal in character. They are smoother in texture than the surrounding landscape.

Areas on-site that have been reclaimed show substantial mitigating effects of reclamation on the visual environment. The irregular softening and rounding of the slopes is more like the natural terrain of the foothills than the angle of repose from dumping on the active waste rock facility. This reclamation reduces the landform and line contrast to a relatively low level. Although shrub growth has not yet reached the level of vegetation of the surrounding environment and the grasses are characteristically sparse, even this fairly early stage of revegetation substantially reduces the color contrast over bare earth.

Structures in the visual analysis area are geometric in form, limited mainly to mining and livestock grazing structures. There also are a few fence lines, an electrical substation, and 120-kilovolt and 230-kilovolt power transmission lines traversing the area. The utility lines have both linear and structural character in the large, open landscape. Roads are prominent linear man-made features in the study area, most apparent in the valleys and side slopes.

The project vicinity is visible from the Boulder Valley Road and from several two-track recreational roads, including one on the ridgeline to the west and southwest of the project. These routes are lightly traveled by the public.

In the CESA, there are landscapes designated for both VRM Class III and Class IV objectives.

3.12.2 Environmental Consequences

Primary issues related to visual resources include whether the proposed project would cause varying levels of contrasts of introduced land forms, vegetation, and structures to the characteristic landscape.

Potential visual impacts associated with the proposed project were analyzed using the procedures outlined in the BLM Visual Contrast Rating Handbook H-8431-1 (BLM 1984). Visual impacts were determined by comparing visual contrast ratings for the proposed project facilities with the VRM class objective (**Table 3.12-1**) for the project vicinity, VRM Class IV (**Figure 3.12-2**). The process involves comparing the degree of visual contrast from the proposed facilities and activities with the existing landscape character both during active mining and after reclamation is complete. The contrast rating process used five KOPs (**Figure 3.12-2**) as the viewpoints for conducting the impact analysis. KOP-1, located directly adjacent to the proposed project on Boulder Valley Road (northbound), was selected to represent the view for travelers approaching from the south along Boulder Valley Road. KOP-2, located at the edge of the proposed project on Boulder Valley Road (southbound), was selected to represent the view for travelers approaching from the north along Boulder Valley Road. KOP-3, is located on the ridge approximately 0.5 mile southwest of the proposed project Plan of Operations boundary. KOP-4, located on the Antelope Creek Road, 2.3 miles from the proposed project boundary, represents the view for travelers situated northwest of the proposed project along Antelope Creek Road. KOP-5, located 15 miles (the outer extent of the VRM background distance zone) south of the proposed project on Boulder Valley Road (northbound), was selected to represent distant views for travelers approaching from the south along Boulder Creek Road. All of the approach routes are lightly traveled and are the only improved routes within the study area. Most traffic in the study area is generated by local mineral development or ranching activity. However, there also is seasonal traffic associated with recreational hunting and camping activities.

3.12.2.1 Proposed Action

Development of the proposed project would expand the amount of visual contrast that currently exists between existing and previously approved facilities, and the natural character of the landscape. The primary change in visual effects from the currently approved levels would be the addition of landforms of the West Waste Rock Disposal Facility (WRDF), East WRDF, Heap Leach Pad No. 12, new mine facilities buildings, and the power transmission line. The proposed project also would extend visual effects through the increased use and activities of the area from the proposed mining activity. As noted in Section 3.12.1, Affected Environment, prior to completion of reclamation, mine features exhibit strong color contrast in the viewshed. In addition, there are moderate to strong line and landform contrasts generated by the shapes of the existing landform modifications. Finally, there is moderate texture contrast between the bare surfaces of the mine features and the vegetation textures and patterns in the natural landscape. The proposed project primarily would expand the visual effects in the foreground-middleground and background viewsheds of the existing mine area, and would be prominent until reclamation is achieved on the WRDFs and leach areas. The visual contrast effects gradually would become less prominent with reclamation.

The proposed facilities would have visual characteristics during active mining that would be similar to existing facilities, notably a geometric form and exposed earth surfaces. As a result, the proposed project would have similar, but expanded, visual effects to those already occurring from the existing facilities, including moderate to strong color contrast, moderate line contrast, and moderate texture contrast. The key considerations, therefore, are the degree of expansion of the visual impacts, and the amount of contrast permissible under the VRM Class IV objective.

Figure 3.12-1 illustrates the viewshed (198,492 acres) of visual impact of the proposed project within the foreground-middleground and background distance zones (15 miles).

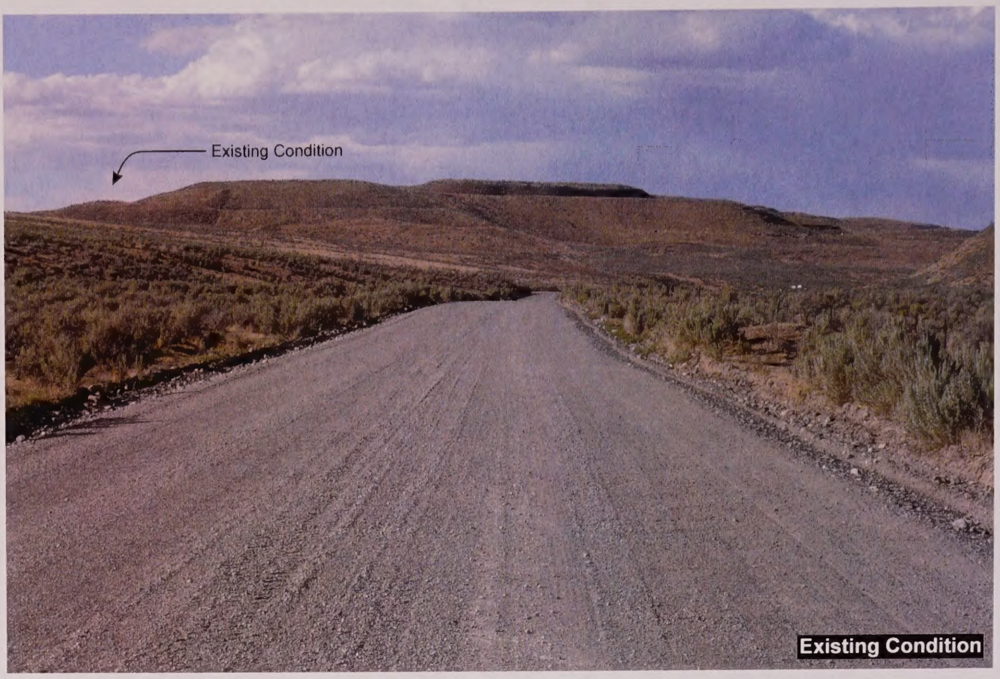
Visual contrasts from the proposed project's landforms would be greatest at KOP-1, KOP-2, KOP-3, and KOP-4. The existing disturbances in the vicinity of the West WRDF and Heap Leach Pad No. 12 have been successfully reclaimed and revegetated. The tallest of the mine office facility buildings would be approximately 65 feet tall and the three communications towers would be 30 to 50 feet tall. Lighting used to facilitate around-the-clock mining would increase the visual contrast at night. All of the area proposed for disturbance is rated VRM Class IV. The objective for Class IV states, "the level of change to the characteristic landscape can be high." Due to the scale of the introduced landforms, the moderate to strong color contrasts, and the moderate to strong line contrasts, it is estimated that the proposed facility would result in a "high" level of landscape change in the short term, during active mining. **Figures 3.12-3** through **3.12-7** illustrate simulations of the visual effects of post-mining and reclamation as seen from KOP-1 through KOP-5.

The proposed mine office facility on the southeastern portion of the mine area would be constructed on land adjacent to the Boulder Valley Road, across the road from the existing Bootstrap Mine. The visual effects would be moderate, because the facility would be seen as an extension of the existing and previously approved activities.

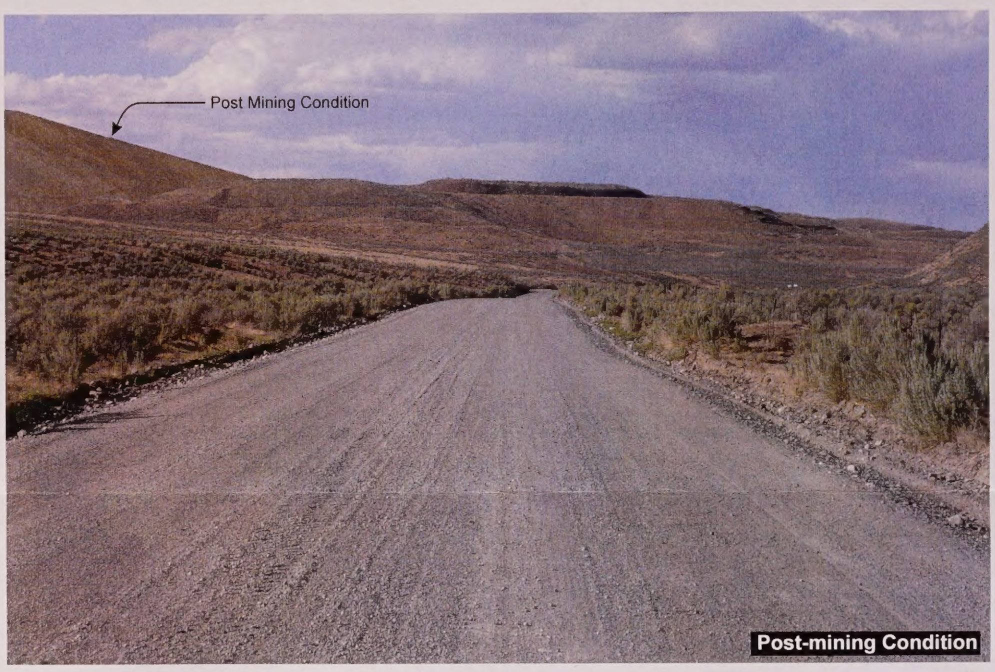
Recent past and ongoing reclamation efforts have been effective at mimicking natural vegetation in the project vicinity. The same reclamation standards would be implemented for the proposed project. As a result, it would be expected that the visual contrasts from facilities would be reduced after reclamation. As a result, the long-term visual effects (as seen from KOP-1 through KOP-5) would be expected to achieve the VRM Class IV objective.

The majority of the proposed project facilities would be visible from KOP-1. The most prominent features that would be visible would be the Heap Leach Pad No. 12 and West WRDF, which would be directly adjacent to the KOP and would rise approximately 370 feet and 615 feet above the natural ground surfaces, respectively. Other facilities would be entirely screened by this intervening terrain. **Figure 3.12-3** illustrates simulations of the visual effects as seen from KOP-1. The strong color contrast of the facility would achieve the Class IV objective during its active life. After successful completion of reclamation, it also would comply with the objective in the long term.

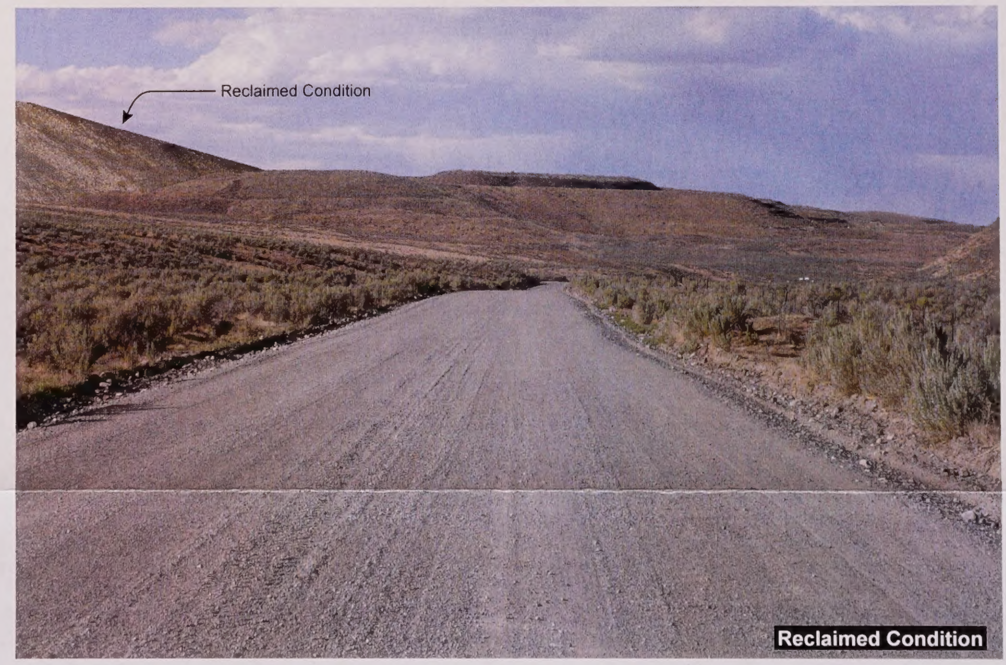
The majority of the proposed project facilities would not be visible from KOP-2, because those areas would be screened from view by the East WRDF. The most prominent feature that would be visible would be the East WRDF, which would be directly adjacent to the KOP and would rise approximately 210 feet above the natural ground surface. Other facilities would be entirely screened by this intervening terrain. **Figure 3.12-4** illustrates simulations of the visual effects as seen from KOP-2. The strong color contrast of the facility would achieve the Class IV objective during its active life. After successful completion of reclamation, it also would comply with the objective in the long term.



Existing Condition



Post-mining Condition

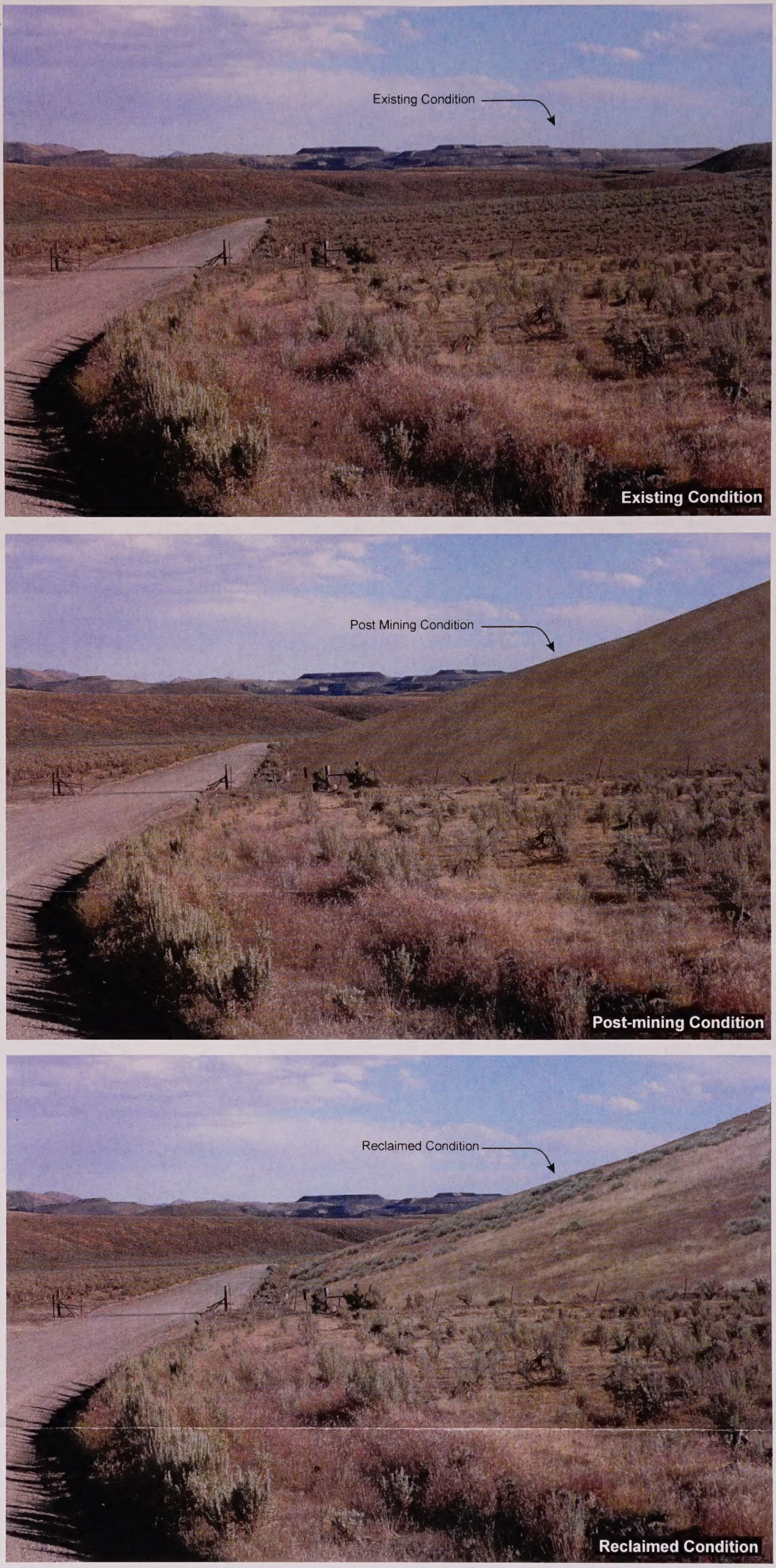


Reclaimed Condition

Arturo Mine Project EIS

Figure 3.12-3
Key Observation Point 1

Visual Simulations

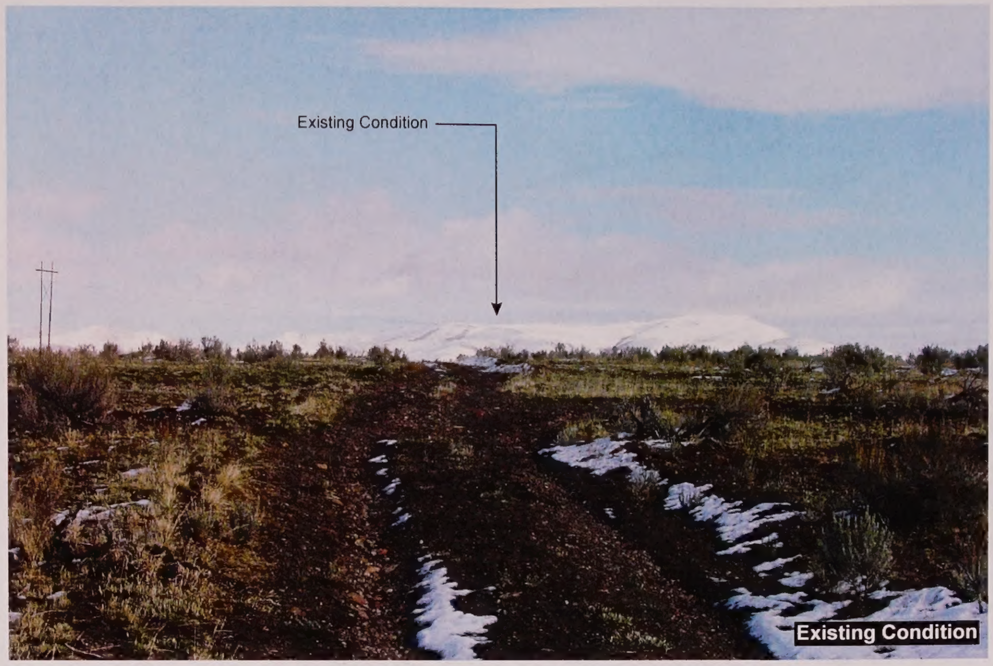


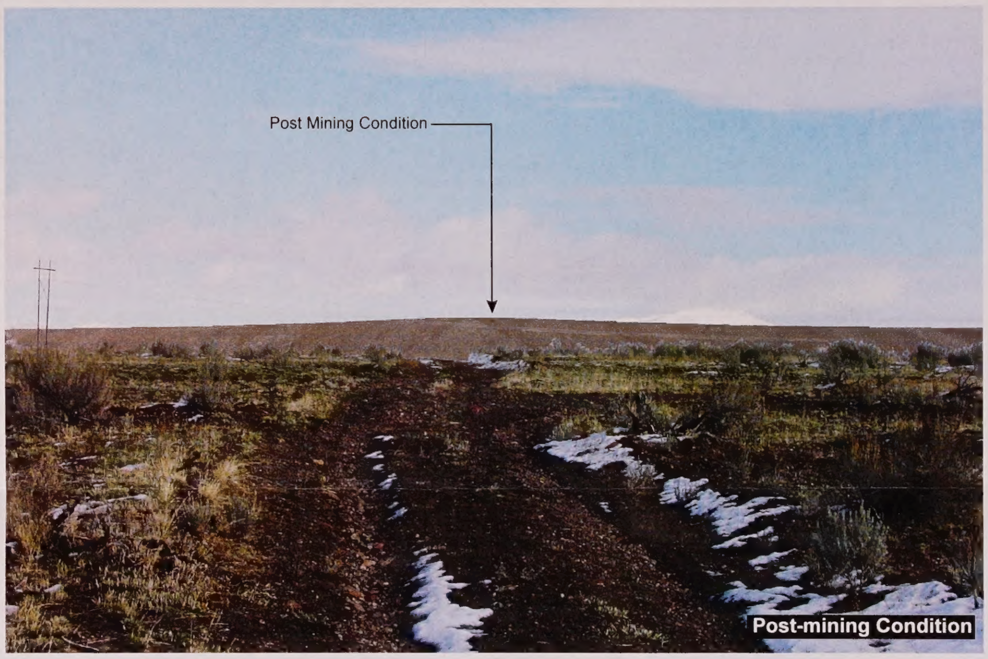
Arturo Mine Project EIS

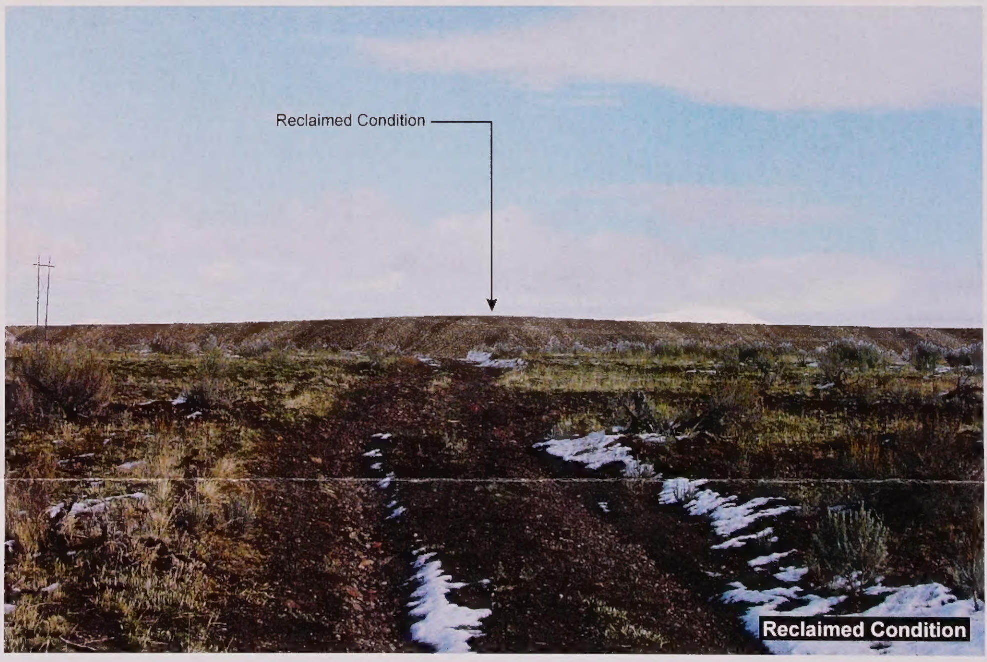
Figure 3.12-4
Key Observation Point 2

Visual Simulations

06/30/2011





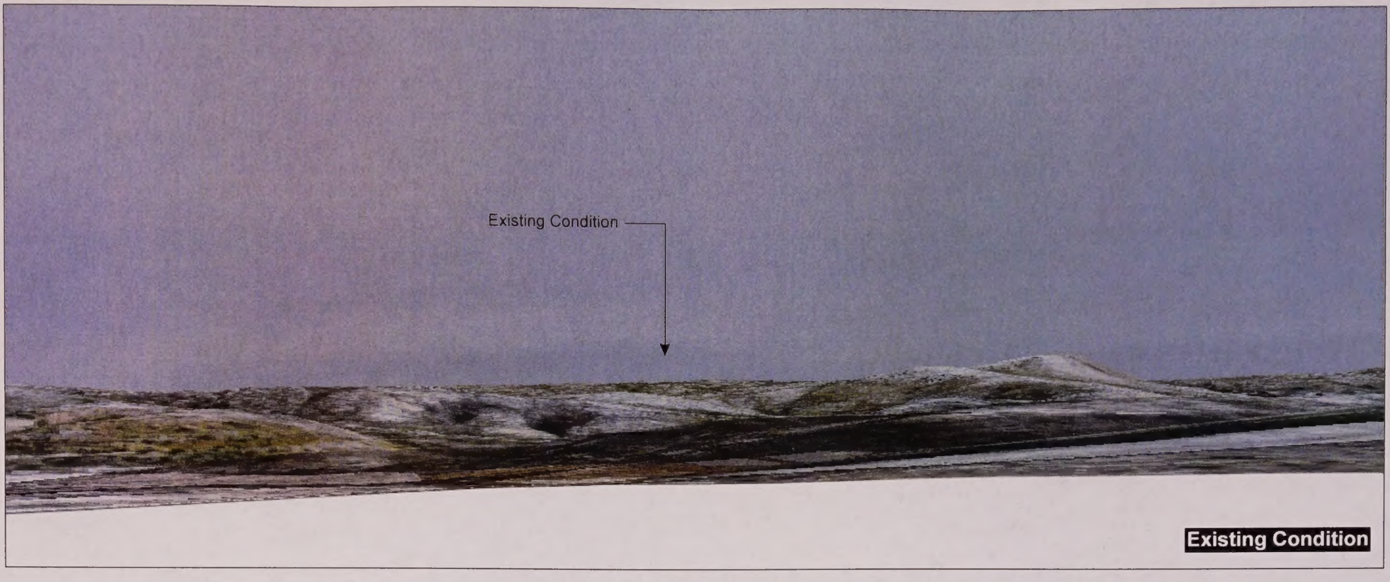


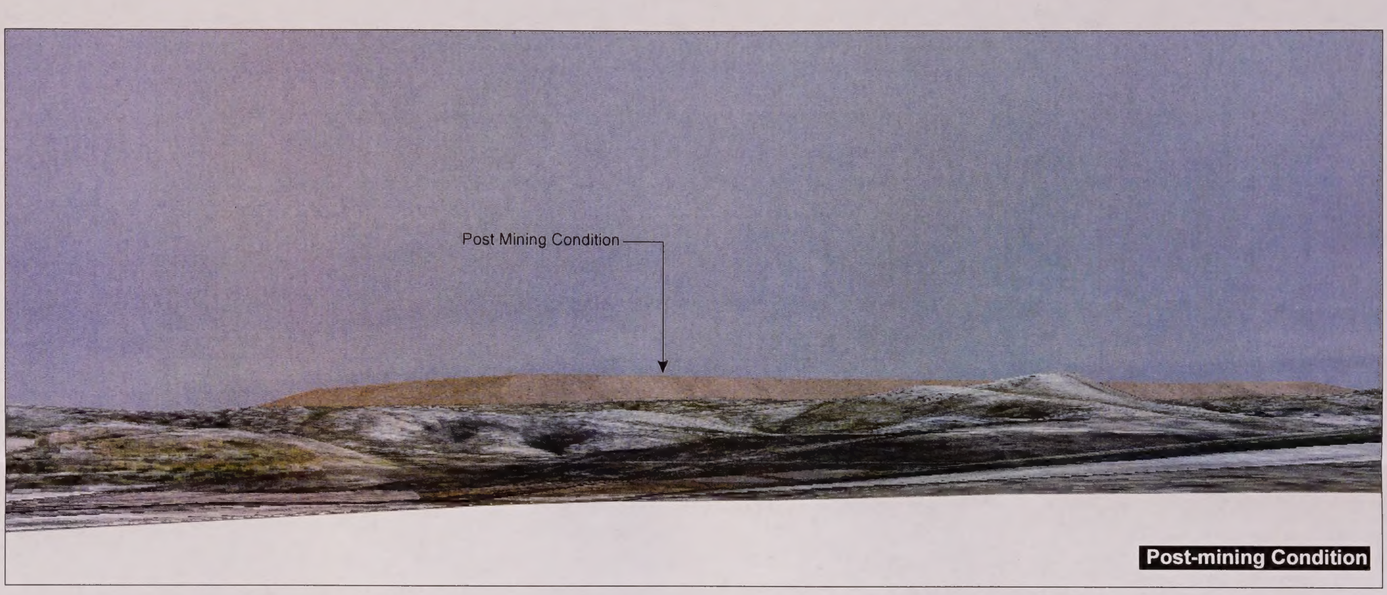
Arturo Mine Project EIS

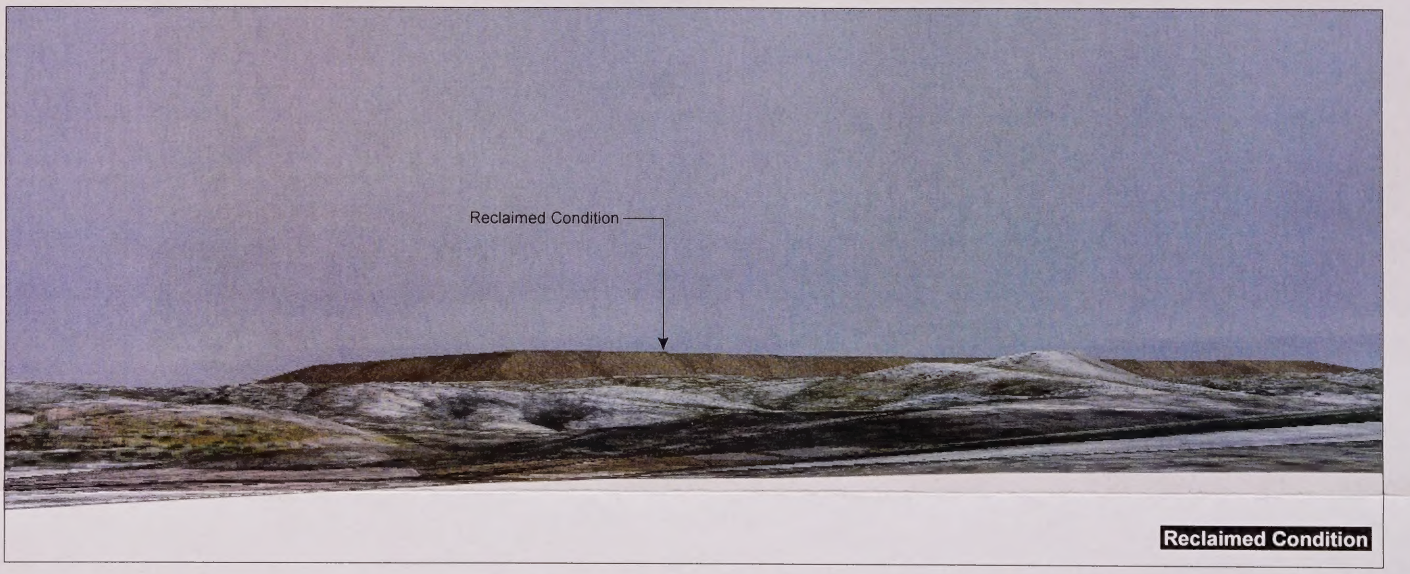
Figure 3.12-5
Key Observation
Point 3

Visual Simulations

06/30/2011



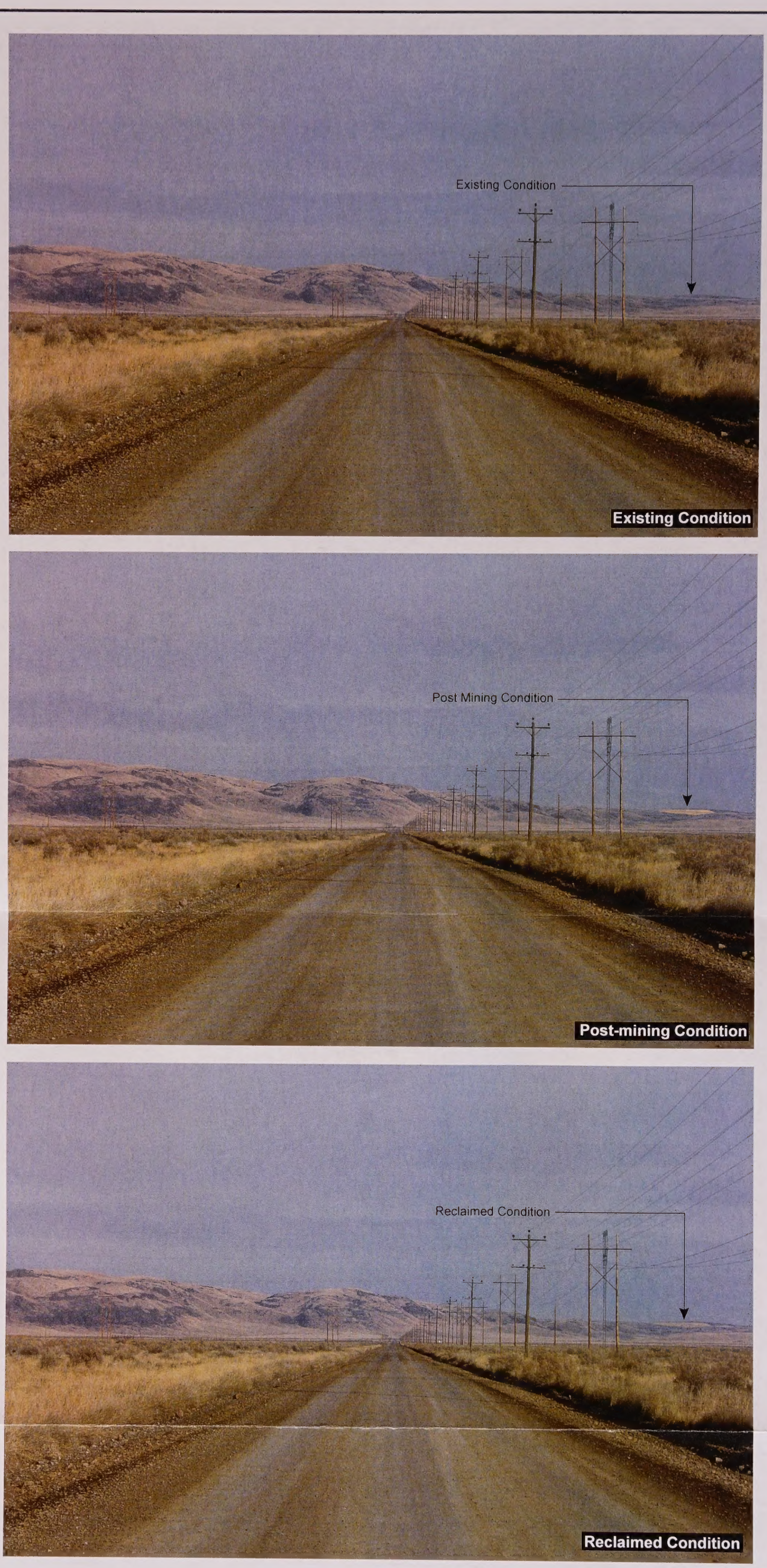




Arturo Mine Project EIS

Figure 3.12-6
Key Observation Point 4

Visual Simulations



Arturo Mine Project EIS

Figure 3.12-7
Key Observation Point 5

Visual Simulations

06/30/2011

The majority of the proposed project facilities would not be visible from KOP-3, because those areas are screened from view by the far edge of the existing foreground landform. The most prominent feature that would be visible would be the West WRDF, which would be slightly over 0.5 mile from the KOP and would rise approximately 615 feet above the natural ground surface. Other facilities would be entirely screened by intervening terrain. **Figure 3.12-5** illustrates simulations of the visual effects as seen from KOP-3. The strong color contrast of the facility would achieve the Class IV objective during its active life. After successful completion of reclamation, it would comply with the objective in the long term. **Figure 3.12-6** illustrates simulations of the visual effects as seen from KOP-4. The most prominent feature that would be visible would be the West WRDF, which would be approximately 2.3 miles from the KOP and would rise approximately 615 feet above the natural ground surface. Other facilities would be entirely screened by intervening terrain.

Figure 3.12-7 illustrates simulations of the visual effects as seen from KOP-5. Visible features would be the West WRDF and Heap Leach Pad No. 12, which would be approximately 15 miles from the KOP and would rise approximately 370 feet and 615 feet above the natural ground surfaces, respectively. Other facilities would be entirely screened by intervening terrain.

The proposed project would comply with the Class IV objective during active mining and after reclamation because this objective provides for "management activities, which require major modification of the existing character of the landscape." In addition, public use of travel routes in the viewshed occurs at a low level.

3.12.2.2 Single Waste Rock Disposal Facility Alternative

Under the Single WRDF Alternative, the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. Under this alternative, the expanded height (approximately 40 feet) and footprint (approximately 54 acres) of the West WRDF would increase visual contrasts as seen from KOP-1, KOP-3, KOP-4, and KOP-5. Elimination of the East WRDF would reduce immediate foreground visual contrasts at KOP-2, as compared with the Proposed Action. Form, line, color, and texture contrasts from KOP-1, KOP-3, and KOP-4 would range from moderate to strong, while the contrasts from KOP-5 would increase slightly, but still remain in the weak ranges. With removal of the East WRDF, the view from KOP-2 would now include mine facilities in the foreground-middleground distance zone which would cause weak to moderate visual contrasts in form, line, and color, and weak contrasts in texture. This alternative would comply with the Class IV objective during active mining and after reclamation.

3.12.2.3 Partial Pit Backfill Alternative

Under the Partial Pit Backfill Alternative, there would be a decrease in the visual contrast of the proposed project seen from KOPs 1 through 4, as compared to the Proposed Action. As a result, visual impacts would be less than those identified for the Proposed Action.

3.12.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and additional impacts to visuals resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations. Under the No Action Alternative, the visual effects of the existing project were considered to be minimal.

3.12.3 Cumulative Impacts

The CESA for visual resources is defined in Section 3.12.1, Affected Environment, and is shown in **Figure 3.12-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in

Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.12.3.1 Proposed Action

Future actions that would create visual effects are predominantly mine-related activities, including both exploration and development projects. There also would be a potential increase in the number and extent of dirt roads. Among these actions, the mining projects would be the most likely to introduce visual contrast in the CESA. However, all of the identified future actions would be located in VRM Class III and VRM Class IV areas, so it is anticipated that the visual disturbance would meet the standards of the VRM Class III objective, which provide for "moderate change" in the landscape and VRM Class IV objective, which provide for major change in the landscape. Based on the project's proposed reclamation plan and the assumption that standard reclamation requirements would be required for permitting of future projects, the cumulative visual effects would be minimized to the degree possible after completion of the projects.

3.12.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action, except that this alternative would result in increased visual contrasts in the CESA. However, this alternative would meet the standards of the VRM Class III and Class IV objectives, which provide for "moderate" and "major" changes, respectively.

3.12.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be similar to cumulative effects associated with the Proposed Action, except that this alternative would result in decreased visual contrasts in the CESA.

3.12.3.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and additional impacts to visuals resources would not occur.

3.12.4 Potential Monitoring and Mitigation Measures

No monitoring or mitigation measures are recommended for visual resources.

3.12.5 Residual Impacts

The proposed project would not cause residual impacts since the proposed project would comply with the Class IV objective during active mining and after reclamation.

3.13 Soils and Reclamation

3.13.1 Affected Environment

The study area for soils and reclamation encompasses the proposed Plan of Operations (PoO) boundary; and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor, that occurs outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for soils and reclamation is defined as the Boulder Flat and Rock Creek Valley Hydrographic Areas (**Figure 3.13-1**). The CESA was selected based on the location of the proposed project within the Boulder Flat and Rock Creek Valley Hydrographic Basins.

3.13.1.1 Soils

The proposed project lies within the Great Basin Section of the Basin and Range Province of the Intermountain Plateaus, Owyhee High Plateau Major Land Resource Region (U.S. Department of Agriculture-Natural Resources Conservation Service [USDA-NRCS] 2006). Soils within the study area are primarily derived from volcanic rock and have developed on lower mountain slopes and hills including alluvial fans, pediments, and terraces.

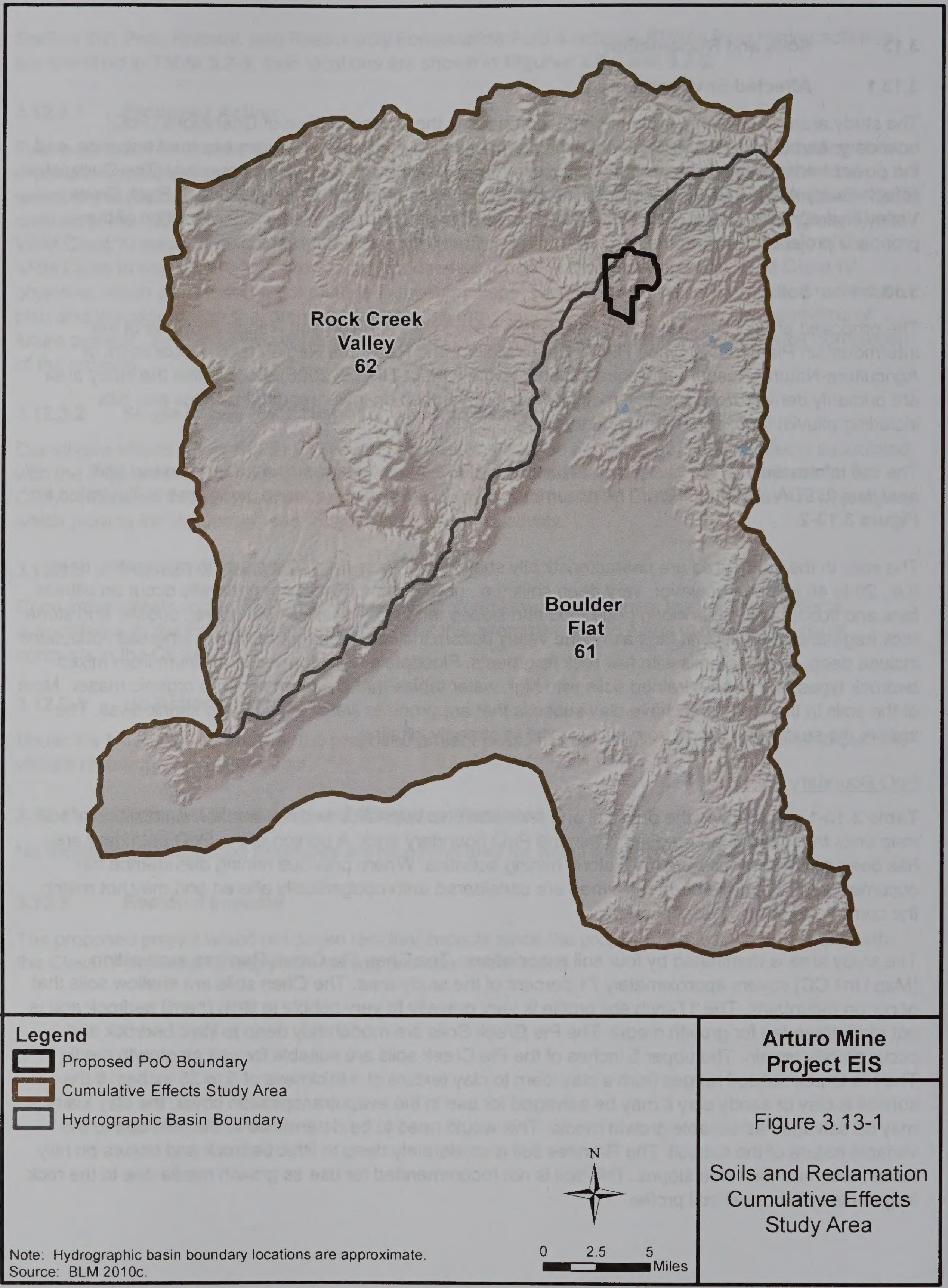
The soil information for the study area is based on Soil Survey Geographic database review and analyses (USDA-NRCS 2010a). The occurrence of soils within the proposed study area is illustrated in **Figure 3.13-2**.

The soils in the study area are characteristically shallow (i.e., less than 20 inches) to moderately deep (i.e., 20 to 40 inches); however, very deep soils (i.e., greater than 60 inches) generally occur on alluvial fans and floodplains. Soils along ridge tops and slopes tend to be shallow with gravel, cobble, and stone rock fragments. The alluvial fans along the valley bottom include deep, gravelly soils whereas floodplains include deep, stratified soils with few rock fragments. Floodplain soils, formed in alluvium from mixed bedrock types, are poorly drained soils with high water tables that are often richer in organic matter. Most of the soils in the study area have clay subsoils that are prone to water erosion and shrink-swell. The soils in the study area range from slightly acid to strongly alkaline.

PoO Boundary Area

Table 3.13-1 summarizes the physical and chemical characteristics and reclamation suitabilities of soil map units that have been mapped within the PoO boundary area. A portion of the PoO boundary area has been previously disturbed by historic mining activities. Where previous mining disturbance has occurred, soils that have been reclaimed are considered anthropogenically altered and may not match the current soil survey descriptions.

The study area is dominated by four soil associations. The Chen-Pie Creek-Ramires association (Map Unit CC) covers approximately 71 percent of the study area. The Chen soils are shallow soils that occur on mountains. The 17-inch soil profile is very gravelly to very cobbly to lithic (hard) bedrock and is not recommended for growth media. The Pie Creek Soils are moderately deep to lithic bedrock and occur on hilly terrain. The upper 5 inches of the Pie Creek soils are suitable for use as growth media. The Pie Creek subsoil ranges from a clay loam to clay texture at a thickness of 5 to 35 inches. If the subsoil is clay or sandy clay it may be salvaged for use in the evapotranspiration cover; the clay loam may be salvaged as suitable growth media. This would need to be determined in the field due to the variable nature of the subsoil. The Ramires soil is moderately deep to lithic bedrock and occurs on hilly terrain and mountain side slopes. This soil is not recommended for use as growth media due to the rock fragments in the upper soil profile.



Note: Hydrographic basin boundary locations are approximate.
Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.13-1

Soils and Reclamation Cumulative Effects Study Area

05/31/2012

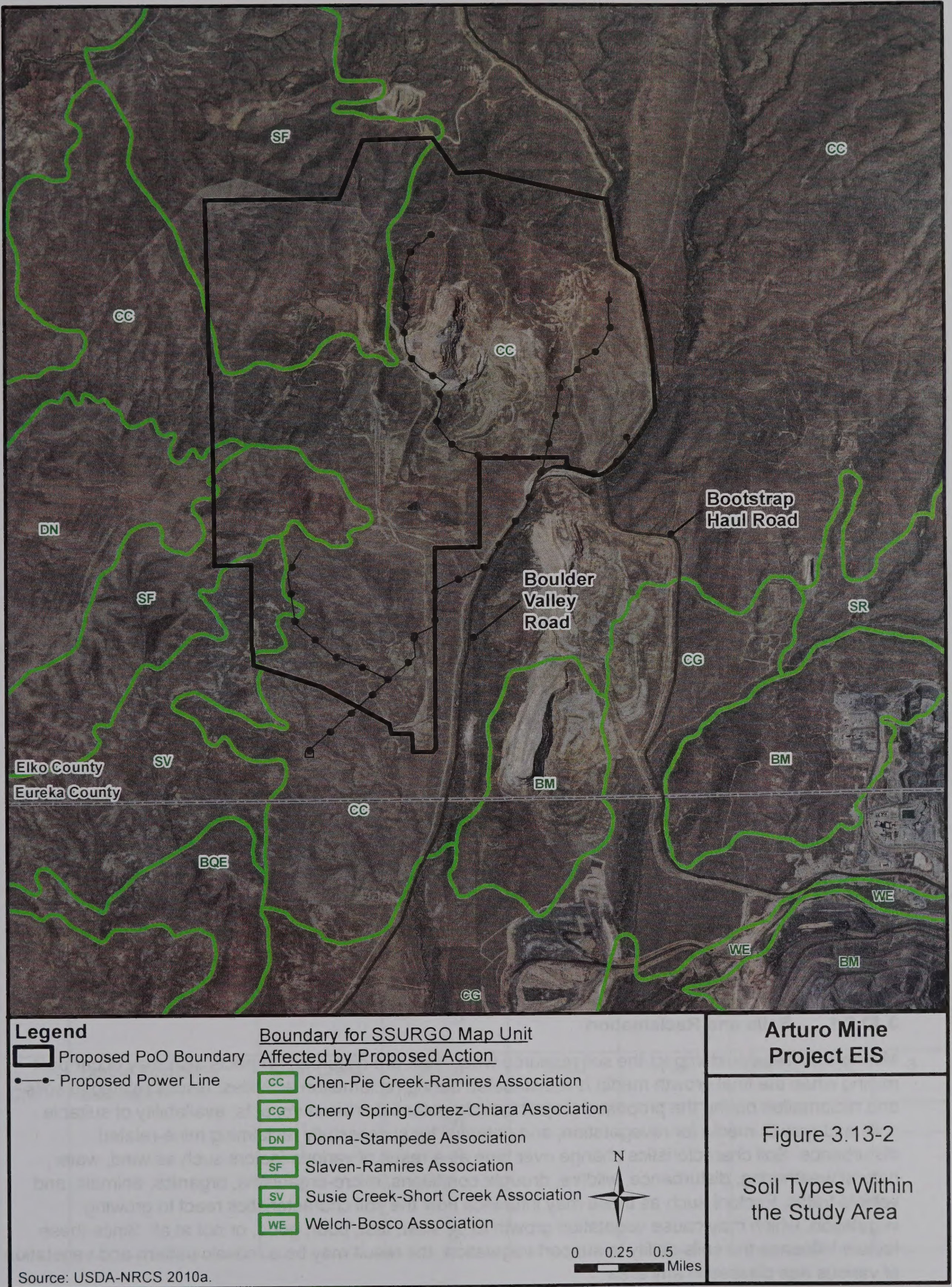

SF
CC
CC
CC
DN
SF
Bootstrap Haul Road
Boulder Valley Road
SR
CG
BM
SV
Elko County
Eureka County
BM
CC
BQE
WE
WE
BM
CG
Legend
Proposed PoO Boundary
Proposed Power Line
Boundary for SSURGO Map Unit Affected by Proposed Action
CC Chen-Pie Creek-Ramires Association
CG Cherry Spring-Cortez-Chiara Association
DN Donna-Stampede Association
SF Slaven-Ramires Association
SV Susie Creek-Short Creek Association
WE Welch-Bosco Association
N
0 0.25 0.5 Miles
Arturo Mine Project EIS

Figure 3.13-2

Soil Types Within the Study Area

Source: USDA-NRCS 2010a.

05/16/2012

The Slaven-Ramires association (Map Unit SF) covers approximately 26 percent of the study area. The Slaven soils are moderately deep soils that occur on hills and mountain side slopes. The soil profile is very to extremely gravelly to lithic bedrock and is not recommended for growth media.

The Susie Creek-Pie Creek association (Map Unit SV) covers approximately 2 percent of the study area. The Susie Creek soils are deep to paralithic (soft) bedrock and occur on mountain slopes and ridges. The upper 12 inches of the Susie Creek soils are suitable for use as growth media. The Susie Creek subsoil ranges from a clay loam to clay texture at a depth of 12 to 25 inches. If the subsoil is clay or sandy clay it may be salvaged for use in the evapotranspiration cover. The clay loam also may be salvaged as suitable growth media. It may be necessary to field verify subsoil textures due to the variable nature of the soils.

The Donna-Stampede association (Map Unit DN) covers less than 1 percent of the study area. Refer to **Table 3.13-1** for a description of these soils.

In general, native soils in the study area are high in rock fragments with clay subsoils. Growth media and evapotranspiration cover materials may be limited due to rock fragment content. Sorting rock fragments from the soil materials may provide additional growth media and cover material, if needed, for reclamation purposes. In previously disturbed and reclaimed areas, up to 12 inches of soil may be available to salvage as growth media.

Bootstrap Haul Road

Table 3.13-2 summarizes the physical and chemical characteristics of soil map units that occur within the proposed Bootstrap Haul Road corridor. A soil map unit is generally composed of more than one soil. Each soil is given a percentage of the map unit, and soil characteristics are calculated based on that percentage. For instance, although 80 acres of the Cherry Spring-Cortez-Chiara association occur within the corridor, only 32 acres have low reclamation potential. No severely wind erodible soils or prime farmland soils occur within the proposed road corridor.

Utility Corridor

The proposed utility corridor consists of approximately 9 acres, primarily which occur on the Chen-Pie Creek-Ramires association. The soil characteristics for the Chen-Pie Creek-Ramires association and the soils that occur within the corridor inside the PoO boundary are described in Section 3.13.1.1, Affected Environment.

3.13.2 Environmental Consequences

Primary issues related to soils include potential erosion impacts; availability of suitable soils and growth media for revegetation; potential for successfully restoring post-mining land uses; protection of public safety after mine reclamation and closure; and mine site stabilization.

3.13.2.1 Soils and Reclamation

Mining activities could impact the soil resource when soils are disturbed. Impacts also may occur post mining when the final growth media is redistributed during reclamation activities. Issues related to soils and reclamation during the proposed project include potential erosion impacts; availability of suitable soils and growth media for revegetation; and potential for successfully reclaiming mine-related disturbance. Soil characteristics change over time as a result of various factors such as wind, water, natural weathering, disturbance, wildfire, drought conditions, micro-organisms, organics, animals, and vehicle traffic. Factors such as these may influence how the soil characteristics react to growing vegetation, which may cause vegetation growth to be slow, fast, poor, good, or not at all. Since these factors influence the soils ability to support vegetation, the result may be a mosaic pattern and vegetation of various age classes in any area.

Table 3.13-1 Study Area Soils

Map Unit ID	Map Unit Name	Component Name	Comp %	Total Acres	Horizon	Horizon Top Depth (inches)	Horizon Bottom Depth (inches)	Texture	pH	SAR[1]	EC[2]	Water Erosion[3]	Wind Erosion[4]	Hydric Rating	Slope (%)	Growth Media Potential	Growth Media Limiting Factors[5]	RSD[6]
CC	Chen-Pie Creek-Ramires association	Chen	40	2502.34	H1	0	8	Cobbly loam	6.6-7.8	0-0	0-0	Not Severe	moderate	No	15-30	Poor	CL, D, BR, OM, SL, R	0
					H2	8	17	Very cobbly clay, very gravelly clay, extremely gravelly clay	6.6-7.8	0-0	0-0	Not Severe	moderate	No				
					H3	17	21	Unweathered bedrock	-	-	-		moderate	No				
CC	Chen-Pie Creek-Ramires association	Pie Creek	20		H1	0	5	Very cobbly loam	6.6-7.3	0-0	0-0	Not Severe	low	No	15-30	Poor	CL, D, BR, SL	0
					H2	5	21	Clay	6.6-7.3	0-0	0-0	Not Severe	low	No				
					H3	21	30	Clay, clay loam	7.4-8.4	0-0	0-2	Not Severe	low	No				
					H4	30	34	Unweathered bedrock	-	-	-		low	No				
CC	Chen-Pie Creek-Ramires association	Ramires	20		H1	0	9	Stony loam	6.6-7.3	0-0	0-0	Not Severe	low	No	15-30	Poor	CL, BR, D, OM, SL, R	0
					H2	9	26	Clay, gravelly clay, gravelly clay loam	6.6-7.8	0-0	0-0	Not Severe	low	No				
					H3	26	34	Sandy clay loam, sandy loam	7.9-8.4	0-0	2-4	Not Severe	low	No				
					H4	34	38	Unweathered bedrock	-	-	-							
CC	Chen-Pie Creek-Ramires association	Cumulic Haplaquolls	5		H1	0	5	Loam	6.1-7.3	0-0	0-0	Severe	moderate	Yes	0-2	Poor	W	60
DN	Donna-Stampede association	Donna	40	12.28	H1	0	8	Gravelly loam	6.1-7.3	0-0	0-0	Severe	moderate	No	2-8	Poor	CL, D, E, R	8
					H2	8	22	Clay	6.6-7.3	0-0	0-0	Not Severe	moderate	No				
					H3	22	38	Indurated	-	-	-		moderate	No				
					H4	38	68	Stratified extremely gravelly sandy loam to gravelly sandy clay loam	7.4-8.4	0-0	0-4	Not Severe	moderate	No				
DN	Donna-Stampede association	Stampede	20		H1	0	12	Gravelly loam	6.1-7.3	0-0	0-0	Severe	low	No	4-15	Poor	CL, D, OM, E, SL	12
					H2	12	28	Clay	6.6-7.8	0-0	0-0	Not Severe	low	No				
					H3	28	33	Indurated	-	-	-		low	No				
					H4	33	60	Extremely gravelly loamy sand	7.9-9	0-0	0-0	Not Severe	low	No				
DN	Donna-Stampede association	Short Creek	20		H1	0	8	Gravelly clay loam	6.6-7.3	0-0	0-0	Not Severe	low	No	30-50	Fair	OM, CL, D, SL, R	8
					H2	8	23	Very gravelly clay	6.6-8.4	0-0	0-0	Not Severe	low	No				
					H3	23	60	Extremely gravelly clay loam, extremely gravelly sandy clay, extremely gravelly sandy clay loam	7.9-9	0-0	0-0	Not Severe	low	No				

Table 3.13-1 Study Area Soils

Map Unit ID	Map Unit Name	Component Name	Comp %	Total Acres	Horizon	Horizon Top Depth (inches)	Horizon Bottom Depth (inches)	Texture	pH	SAR[1]	EC[2]	Water Erosion[3]	Wind Erosion[4]	Hydric Rating	Slope (%)	Growth Media Potential	Growth Media Limiting Factors[5]	RSD[6]
DN	Donna-Stampede association	Welch	5		H1	0	5	Loam	6.1-7.3	0-0	0-0	Severe	moderate	Yes	0-2	Poor	W	60
					H2	5	60	Stratified sandy loam to silty clay loam	6.1-7.8	0-0	0-0	Not Severe	moderate	Yes				
SF	Slaven-Ramires association	Slaven	45	919.88	H1	0	5	Very gravelly loam	6.1-7.3	0-0	0-0	Not Severe	low	No	15-30	Poor	D, CL, BR, OM, SL, R	
					H2	5	22	Extremely gravelly clay, extremely gravelly clay loam, extremely gravelly sandy clay	6.6-7.3	0-0	0-0	Not Severe	low	No				
					H3	22	26	Unweathered bedrock	-	-	-		low	No				
SF	Slaven-Ramires association	Ramires	45		H1	0	9	Gravelly clay loam	6.6-7.3	0-0	0-0	Not Severe	low	No	15-30	Poor	CL, D, BR, OM, SL, R	9
					H2	9	26	Clay, gravelly clay, gravelly clay loam	6.6-7.8	0-0	0-0	Not Severe	low	No				
					H3	26	34	Sandy clay loam, sandy loam	7.9-8.4	0-0	2-4	Not Severe	low	No				
					H4	34	38	Unweathered bedrock	-	-	-		low	No				
SV	Susie Creek-Pie Creek association	Susie Creek	50	77.49	H1	0	12	Loam	6.6-7.8	0-0	0-0	Severe	moderate	No	4-15	Fair	OM, SL, R	12
					H2	12	25	Clay, clay loam, sandy clay	7.4-8.4	0-0	0-2	Not Severe	moderate	No		Fair		
					H3	25	57	Coarse sandy loam, loam, sandy loam	7.9-9	1-5	0-2	Not Severe	moderate	No		Fair		
					H4	57	61	Weathered bedrock	-	-	-		moderate	No		Fair		
SV	Susie Creek-Pie Creek association	Pie Creek	20		H1	0	5	Loam	6.6-7.3	0-0	0-0	Severe	moderate	No	15-30	Poor	CL, BR, E, D, SL	5
					H2	5	21	Clay	6.6-7.3	0-0	0-0	Not Severe	moderate	No		Poor		
					H3	21	35	Clay, clay loam	7.4-8.4	0-0	0-2	Not Severe	moderate	No		Poor		
					H4	35	39	Unweathered bedrock	-	-	-		moderate	No		Poor		
SV	Susie Creek-Pie Creek association	Pattani	20		H1	0	10	Clay	6.6-7.8	0-0	0-0	Not Severe	moderate	No	4-15	Poor	CL, BR, D, OM, SL, R	0
					H2	10	20	Clay, clay loam, silty clay loam	7.9-9	1-5	0-0	Not Severe	moderate	No				
					H3	20	24	Weathered bedrock	-	-	-		moderate	No				

[1] Sodium Adsorption Ratio.

[2] Electrical Conductivity.

[3] Water erosion hazard class determined from Soil Erodibility Factor (Kw) .

[4] Wind erosion hazard class based on Wind Erodibility Group Rating.

[5] Limiting Factors: BR – Depth to Bedrock; CC – Cobble Content; D – Droughty; E – Erosion; OM – Low Organic Matter; R – Rock Fragments; S – Salinity; SL – Slope; SD – Too Sandy; CL – Too Clayey; W – Depth to Water Table.

[6] Recommended Soil Salvage Depth.

Source: USDA-NRCS 2010a.

Table 3.13-2 Soil Limitations Associated with the Bootstrap Haul Road (acres)

Map Unit ID	Map Unit Name	Map Unit	Water Erosion[1]	LRP[2]	Hydric	Compaction Prone[3]	Shallow Bedrock	Stony Rocky	Droughty
CC	Chen-Pie Creek-Ramires association	27.8	22.2	5.6	1.4	16.7	22.2	22.2	0
CG	Cherry Spring-Cortez-Chiara association	80	0	32	0	0	0	48	16
WE	Welch-Bosco association	0.2	0	0	0	0.2	0	0.2	0
Total		108	22.2	37.5	1.4	16.8	22.2	70.4	16

[1] Water erosion hazard class determined from Soil Erodibility Factor (Kw) for surface horizons and slope.

[2] LRP = soils with high strong acidity, strong alkalinity, salinity, or sodic properties.

[3] Compaction Prone = surface horizons are a sandy clay loam or finer.

Source: USDA-NRCS 2010a.

3.13.2.2 Proposed Action

Soils

Under the proposed project, mine development and operation would disturb approximately 2,774 acres from surface disturbance activities. Approximately 269 acres would occur in areas of existing disturbance, 543 acres would occur in previously disturbed but reclaimed areas, and 1,962 acres would occur in previously undisturbed areas. Soil units that are located in proposed disturbance areas are shown in **Figure 3.13-2.**

Soils subject to water erosion include steeply sloping land with shallow soils. Erosion hazard of the native soils in the study area are shown in **Table 3.13-1**. Sandy and silty textured, sparsely vegetated soils are subject to wind erosion. Although accelerated erosion due to mining-related soil disturbance could occur at any stage of the proposed project, the maximum potential for erosion within the study area would be expected while soils are loose, with no established cover. Erosion also would be of concern after reclamation work has occurred but before a vegetative cover has been reestablished. If the ground surface is left smooth and barren during this period, winds could dislodge soil particles and rainfall intercepting barren surfaces could result in increased erosion.

Soil compaction occurs when soil particles are pressed together by an applied load and the pore spaces between them are reduced while bulk density is increased. Moist fine textured soils are most susceptible to severe compaction by equipment and haul trucks. However, compaction also may occur on loamy to coarse textured soils and under drier conditions due to multiple passes by heavy mechanical equipment. Compaction damages soil structure and reduces pore space, which impedes the movement of air and water to plant roots and can result in lower growth rates and hinder revegetation. Compaction reduces infiltration and results in excessive surface runoff, erosion, nutrient loss, and potential water quality problems.

Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting physically severs roots and reduces the aeration and infiltration of the soil, thereby degrading the rooting environment. Rutting also disrupts natural surface water hydrology by damming surface water flows, creating increased soil saturation upgradient from ruts, or by diverting and concentrating water flows creating accelerated erosion. Rutting is most likely to occur on moist or wet fine-textured soils but also may occur on dry sandy soils due to their low soil strength.

Soil compaction and rutting could result from the movement of heavy mining vehicles. The degree of compaction would depend on the moisture content and texture of the soil at the time of impact. Compaction would be most severe where heavy equipment operates on moist to wet soils with high clay contents. Reclamation of disturbed sites would include ripping compacted surfaces to loosen the soil.

Soil contamination could result from material spills during mining activities. If large spills occur, contamination could result in the removal and disposal of large amounts of soil. Saturated soils have the potential to diffuse contaminants. As described in the PoO, implementation and maintenance of measures from the Reclamation Plan and Spill Prevention, Control, and Countermeasures Plan would reduce the potential for impacts to soils from spills. If spills occur, they would be cleaned up in accordance with local, state, and federal regulations.

Replacement of growth media is proposed for major disturbances associated with the study area. Topsoil would be salvaged from previously undisturbed native soils for use as growth media during reclamation. The recommended salvage depth for native soil material is identified in **Table 3.13-1**. Growth media would not be salvaged from previously reclaimed areas. As stated in Section 2.3.8.4, Cover Material, cover material growth media for reclamation may be comprised of both native topsoil and suitable unconsolidated waste rock (Carlin Formation material). The proposed Waste Rock Disposal Facility (WRDF) configurations are discussed in Section 2.3.3, Waste Rock Disposal Facilities. Reclamation of proposed disturbances and the use of Carlin material as growth media are further discussed in Section 2.3.8, Closure and Reclamation Plan. Although Carlin material has been utilized successfully in the region as reclamation material, no data is specifically available on the physical and chemical suitability of Carlin Formation material at the Arturo Mine site. Variability can exist between Carlin formation materials specifically in relation to particle size and rock fragment content. Due to the variability of Carlin Formation materials, Barrick Dee Mining Venture (BDMV) would selectively salvage and stockpile materials with less than 35 percent coarse fragments by volume and exclude soils with USDA texture classes of clay and silty clay as growth media. The growth media selected from Carlin Formation materials would be selected by field observation prior to salvage. Records would be maintained on confirmatory samples analyzed for coarse fragment content and USDA texture class. Effective identification, handling, and placement of growth media requires both a knowledge of the physical and chemical properties of that media.

Overall site productivity is primarily a matter of revegetation success. Productivity varies with vegetation community, but more importantly, with land management objectives as they relate to the establishment of desirable or productive vegetation types. In contrast, soil quality is an inherent soil resource characteristic involving aeration, permeability, texture, salinity and alkalinity, microbial populations, fertility, and other physical and chemical characteristics that are accepted as beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to the existing quality of native soils from project-related disturbance.

Growth media excavation, transport, storage, and redistribution would modify the existing soil structure, generating adverse impacts relative to aeration and permeability. It is likely that some mixing of textural zones would occur, as well as mixing of saline and/or alkaline materials with relatively salt-free materials. This mixing could create adverse chemical impacts to soil quality for seedbeds. Currently existing microbial populations would likely decrease during growth media stockpiling and storage. Due to these probable effects, the initial soil quality of reconstructed seedbeds and root zones would be less than that of the existing soil resources. In addition, compaction from vehicular traffic would occur during construction of the proposed power transmission line and operation activities, temporarily decreasing soil quality in those areas.

These impacts would be reduced based on BDMV's commitment to reclaim project components and successfully restore productive post-mining land uses. These objectives would be attained through the use of Best Management Practices (BMPs). Revegetation of disturbance areas would be conducted as soon as practical to reduce the potential for wind and water erosion, minimize impacts to soils and vegetation, help prevent the spread of noxious weeds and non-native invasive plants in disturbance areas, and facilitate post-mining land uses. Following construction activities, areas such as cut-and-fill embankments and growth media stockpiles would be seeded with an interim seed mix. Concurrent reclamation would be conducted to the extent practical to accelerate revegetation of disturbance areas. In addition, state and federal reclamation requirements call for revegetation monitoring in comparison with established quantitative standards for the locale. A period of overall reclamation monitoring (and maintenance as necessary) is required prior to agency approval of reclamation. Based on these requirements, it is likely that short- to long-term (e.g., up to 10 years or more) decreases in soil quality would not limit the attainment of overall post-mining land use objectives. Over time, soil quality on reclaimed and revegetated sites would resemble pre-mining conditions. Substantial effects on the desired post-mining site productivity from soil quality impacts are not anticipated.

After proposed operations cease, reclamation and closure plans would be implemented in accordance with permit requirements. The conceptual project closure and reclamation plan for the study area is discussed in Section 2.3.8, Closure and Reclamation Plan. Many features of the Reclamation Plan and the associated regulatory program address potential long-term watershed issues. With respect to watershed considerations, the Reclamation Plan developed by BDMV addresses recontouring, growth media, restoration and revegetation, reclamation of project related disturbance, and measures to minimize sediment contributions to surface waters.

3.13.2.3 Single Waste Rock Disposal Facility Alternative

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of soil disturbance. Impacts to soil resources would be similar to the Proposed Action.

3.13.2.4 Partial Pit Backfill Alternative

This alternative would result in the same acreage of disturbance to soils as the proposed action. The primary difference is that WRDF's would be different heights than the proposed action and the pit would be partially filled with waste rock, covered with growth media, and revegetated. This would reduce the acreage of irreversible impacts to soil resources because soils would be brought back to a productive state where the pit has been filled and revegetated. The soils on the reclaimed WRDF's and backfilled pit would be prone to erosion until successfully revegetation is achieved specifically due to the slope length of the southwest slope that grades into the south pit.

BMPs would be used to limit erosion and reduce sediment in precipitation runoff from project facilities and disturbed areas during construction, operation, and initial stages of reclamation. BMPs may include, but would not be limited to, diversion and routing of storm water using accepted engineering practices, such as diversion ditches, and the placement of erosion control devices, such as sediment traps and rock and gravel cover.

3.13.2.5 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and associated impacts to soil resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations.

3.13.3 Cumulative Impacts

The CESA for soil resources is defined in Section 3.13.1, Affected Environment, and is shown in **Figure 3.13-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

Cumulative impacts to soil resources from the proposed project would include additional disturbance of soils in the proposed project, and further modification of drainage patterns. The proposed project would necessitate the excavation and storage of additional soil materials as growth media. In most cases, suitable pit alluvium would be substituted or used in conjunction with native surface soil as growth media. Cumulative effects to runoff and drainage characteristics would be mitigated by implementation of the Reclamation Plan. Surface configurations and drainage controls would manage runoff from the proposed project, concurrent with operations and over the long-term. As a result, effects to drainages and watershed stability are expected to be minimal.

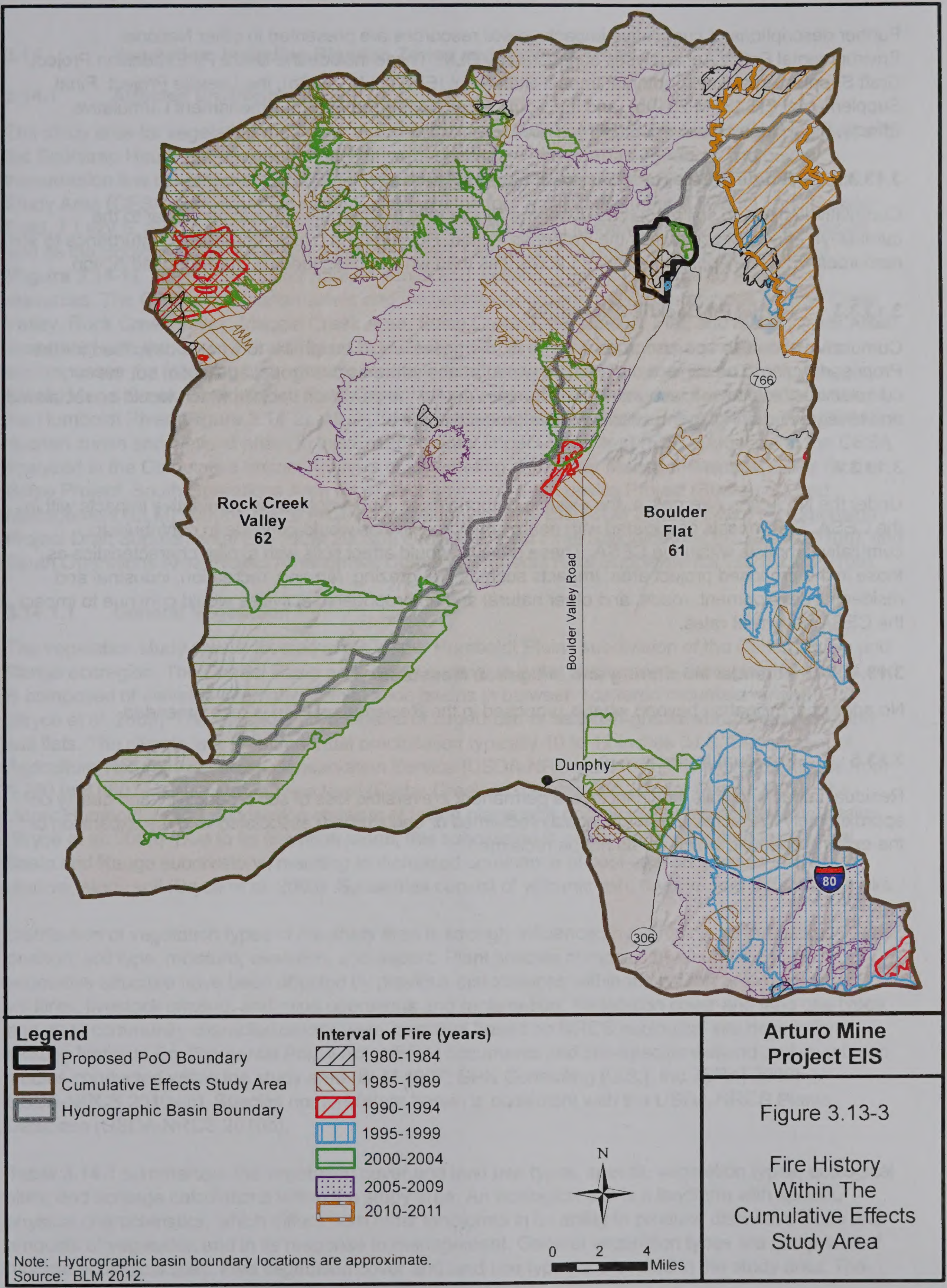
Cumulative impacts to soils result from surface disturbance related to mining and exploration, energy development, wildfire, grazing, dispersed recreation, roads, and other natural and anthropogenic activities within the analysis area.

3.13.3.1 Proposed Action

Past, present, and RFFAs within the CESA have resulted, or would result, in approximately 25,576 acres of mine-related surface disturbance. Past, present, and RFFAs from utility and energy development (Ruby Pipeline, North Elko Pipeline, and TS Power Plant) have resulted, or would result, in up to 3,040 acres of additional disturbance. The proposed project incrementally would increase disturbance by an additional 1,962 acres, resulting in a total cumulative disturbance of approximately 30,578 acres, a 7 percent increase over past, present, and RFFAs disturbance. It is assumed that portions of past mining-related and energy development disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue to reduce the impacts to soils. Pending completion of successful reclamation, the incremental additional impacts to soils as a result of the proposed project would be temporary in nature for the majority of the project disturbance area (with the exception of the development of the Arturo Pit).

In addition to mine and energy development activities in the CESA, numerous wildfires have occurred in the study area, creating additional regional impacts to soils. **Figure 3.13-3** shows the locations of the wildfires within the CESA. Approximately 346,518 acres have burned within the CESA between 1990 and 2011. Some fires have overlapped onto areas that have been previously burned due to invasion of cheatgrass. Cheatgrass promotes more frequent fires by increasing the biomass and horizontal continuity of fine fuels allowing fire to spread evenly across landscapes where fire was previously restricted to isolated patches (Zouhar 2003). High severity wildfires result in increased water repellency in the soil, which limits infiltration, combustion and increased mobility of some soil nutrients, mortality of some soil organisms, combustion of surface soil organic matter and loss of effective ground cover that leaves the soil susceptible to erosion and could contribute to noxious weed spread (Korb et al. 2004). Detrimental and severe soil effects can occur down to 10 centimeters below the surface (Massman et al. 2003). Areas with detrimental soil conditions can persist for decades.

Seven grazing allotments occur on public lands within the CESA. Where public and private lands are grazed, soils may see an increase in compaction which may result in accelerated runoff and erosion and a reduction in soil quality. Riparian and wetland soils may receive the greatest impact due to the plasticity of the soils and the attraction to ungulates by the higher quality forage.



Arturo Mine Project EIS

Figure 3.13-3

Fire History Within The Cumulative Effects Study Area

Note: Hydrographic basin boundary locations are approximate.
Source: BLM 2012.

05/30/2012

Further descriptions of cumulative impacts to soil resources are presented in other National Environmental Policy Act analyses conducted by BLM. These include the Betze Pit Expansion Project Draft Supplemental Environmental Impact Statement (EIS) (BLM 2008b), the Leeville Project, Final Supplemental EIS (BLM 2010b), and the South Operations Area Project Amendment Cumulative Effects, Final Supplemental EIS (BLM 2010a).

3.13.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects to soil resources under the Single WRDF Alternative would be similar to the cumulative effects described for the Proposed Action. However the overall acreage of disturbance to soil resources would be approximately 128 acres less than what is described for the Proposed Action.

3.13.3.3 Partial Pit Backfill Alternative

Cumulative effects to soil resources under this alternative would be similar to what is described for the Proposed Action. The surface disturbance would be the same as the Proposed Action, but the cumulative effects to soil resources would be less due to the partial pit backfill, which would be reclaimed and revegetated bringing the soils back to a productive state.

3.13.3.4 No Action

Under the No Action Alternative, the existing authorizations would not add to cumulative impacts within the CESA. Soil impacts associated with nearby mining activities would continue to contribute to cumulative impacts within the CESA. These projects would affect soils with similar characteristics as those in the proposed project area. Impacts such as fire, grazing, farming, recreation, industrial and residential development, roads, and other natural and anthropogenic activities would continue to impact the CESA at current rates.

3.13.4 Potential Monitoring and Mitigation Measures

No additional mitigation beyond what is proposed in the Reclamation Plan is recommended.

3.13.5 Residual Impacts

Residual impacts to soils would include a permanent irreversible loss of soil productivity and quality on approximately 472 acres (areas previously reclaimed or undisturbed) associated with the expansion of the existing open pit, which would not be reclaimed.

3.14 Vegetation, Including Riparian Zones and Wetland Areas

3.14.1 Affected Environment

The study area for vegetation resources includes the proposed Plan of Operations (PoO) boundary; and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and power transmission line corridor that occur outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for vegetation resources covers the four grazing allotments (Twenty Five, Boulder Field, T Lazy S, and Marys Mountain) located on the Carlin Trend in the vicinity of the study areas as well as the Boulder Creek Valley area between the T Lazy S and Twenty Five Grazing Allotment (**Figure 3.14-1**). The study area for riparian zones and wetland areas is the same as vegetation resources. The CESAs for riparian zones and wetland areas include the six watersheds (Willow Creek Valley, Rock Creek Valley, Maggie Creek Area, Susie Creek Area, Boulder Flat, and Marys Creek Area) associated with the Carlin Trend (**Figure 3.14-2**). The CESA for riparian zones and wetland areas encompasses the following hydrographic basins located along the Carlin trend: Susie Creek, Maggie Creek, Marys Creek, Boulder Flat, Rock Creek Valley, Willow Creek Valley and the adjoining portion of the Humboldt River (**Figure 3.14-2**). All six basins drain southward to the Humboldt River. The CESA for riparian zones and wetland areas in this Environmental Impact Statement (EIS) is identical to the CESA analyzed in the Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project (Bureau of Land Management [BLM] 2000b), Betze Project Draft Supplemental EIS (BLM 2000c), Betze Pit Expansion Project Draft Supplemental EIS (BLM 2008b), Leeville Project Final Supplemental EIS (BLM 2010b), and South Operations Area Project Amendment Cumulative Effects Final Supplemental EIS (BLM 2010a).

3.14.1.1 General Vegetation

The vegetation study area is located in the Upper Humboldt Plains subdivision of the Central Basin and Range ecoregion. The Central Basin and Range ecoregion is the predominant ecoregion in Nevada and is composed of elevated internally drained xeric basins in between scattered mountain ranges (Bryce et al. 2003). The vegetation is a mosaic of sagebrush or saltbush-greasewood shrublands and salt flats. The climate is arid, with annual precipitation typically 10 to 12 inches (U.S. Department of Agriculture-Natural Resources Conservation Service [USDA-NRCS] 2010c). The elevation ranges from 5,260 to 6,060 feet above mean sea level (Cedar Creek Associates, Inc. [Cedar Creek] 2009). The Upper Humboldt Plains subdivision consists of rolling plains with occasional buttes and low mountains (Bryce et al. 2003). Due to its elevation range, this subdivision is cooler and wetter than the Central Basin and Range subdivisions, resulting in increased dominance of cool-season grasses in areas of shallow, stony soil (Bryce et al. 2003). Substrates consist of volcanic ash, rhyolite, and tuffaceous rocks.

Distribution of vegetation types in the study area is strongly influenced by variations in landscape position, soil type, moisture, elevation, and aspect. Plant species composition, abundance and vegetative structure have been affected by previous disturbances within the project area including wildfires, livestock grazing, and mine operations and reclamation. Vegetation cover and land use types, and plant community characterizations were compiled based on NRCS ecological site descriptions, existing National Environmental Policy Act (NEPA) documents and site-specific wetland and vegetation studies conducted within the study area (BLM 1997; SRK Consulting [U.S.], Inc. [SRK] 2009b,c; USDA-NRCS 2010a,c). Species nomenclature herein is consistent with the USDA-NRCS Plants Database (USDA-NRCS 2010b).

Table 3.14-1 summarizes the vegetation cover and land use types, specific vegetation types, ecological sites, and acreage calculations within the study area. An ecological site is a landform with specific physical characteristics, which differs from other landforms in its ability to produce distinctive kinds and amounts of vegetation and in its response to management. General vegetation types are comprised of multiple ecological sites. Five vegetation cover and land use types are located in the study area. The

Table 3.14-1 General Vegetation Cover and Land Use Types, Specific Vegetation Types, and Ecological Sites within the Study Area

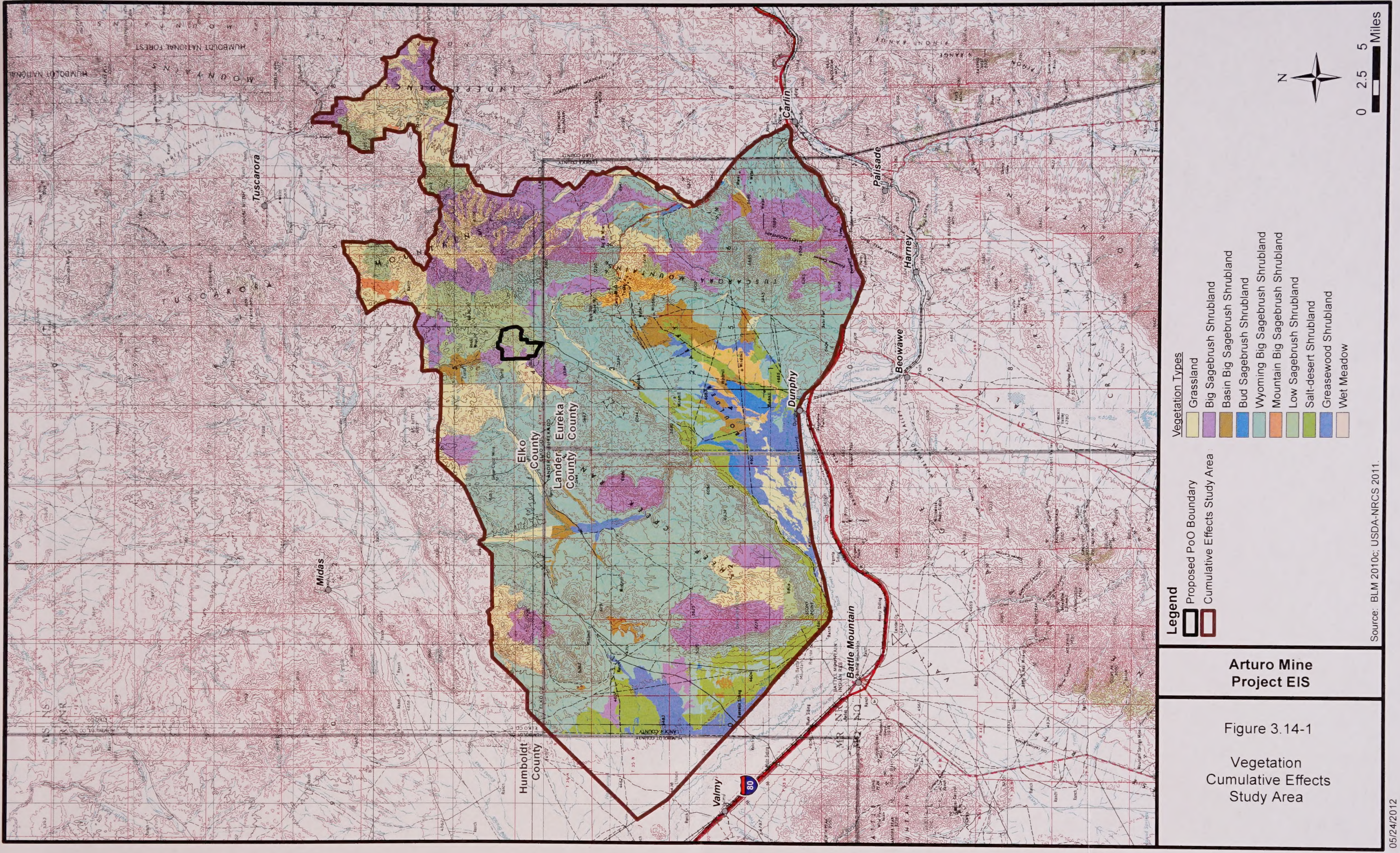
General Vegetation Cover and Land Use Types	Specific Vegetation Types	Ecological Site Code	Ecological Site Name	Acres	Percent of Study Area
New Disturbance					
Grassland	--	025XY018NV	CLAYPAN 10-12 P.Z.	13	<1
Sagebrush Shrubland	Low Sagebrush Shrubland	025XY022NV	COBBLY CLAYPAN 8-12 P.Z.	1,851	48
	Big Sagebrush Shrubland	025XY014NV	LOAMY 10-12 P.Z.	963	25
	Wyoming Big Sagebrush	024XY005NV	LOAMY 8-10 P.Z.	22	1
Riparian Zones and Herbaceous Wetland Areas	--	--	--	5	<1
Previously Disturbed but Reclaimed					
Reclaimed Grasslands	--	--	--	728	19
Existing Disturbance					
Existing Disturbance	--	--	--	269	7

Source: USDA-NRCS 2010a,c.

dominant vegetation cover type is sagebrush shrubland. **Figure 3.14-3** illustrates the vegetation cover and land use types present within the study area.

Previously burned areas caused by wildfires occur in portions of the study area and have been reseeded as part of fire rehabilitation seeding projects in the 1960s and in the 2000s. Species used for the reseeding included crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Pseudoroegneria spicata*), smooth brome (*Bromus inermis*), intermediate wheatgrass (*Thinopyrum intermedium*), western wheatgrass (*Pascopyrum smithii*), slender wheatgrass (*Elymus trachycaulus*), bitterbrush (*Purshia tridentata*), and a grass-legume mixture (SRK 2009c). Crested wheatgrass was the predominant species used for reseeding during the 1960s and a native seed mixture was employed for the reseeding effort during the 2000s (SRK 2009c).

The dominant cover type within the study area, sagebrush shrubland, is composed of a dominant overstory of shrubs and a subdominant understory of herbaceous species. This vegetation type comprises 74 percent of the study area and consists of three specific vegetation types (low sagebrush, big sagebrush, and Wyoming big sagebrush). Usually found on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles and ridges, the substrate for this vegetation type is typically deep, well-drained and non-saline soils. Exposure to desiccating winds is common for these areas. This cover type is found on both burned and unburned areas in the study area. The dominant shrub, depending on location, is mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentate*), or Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*).



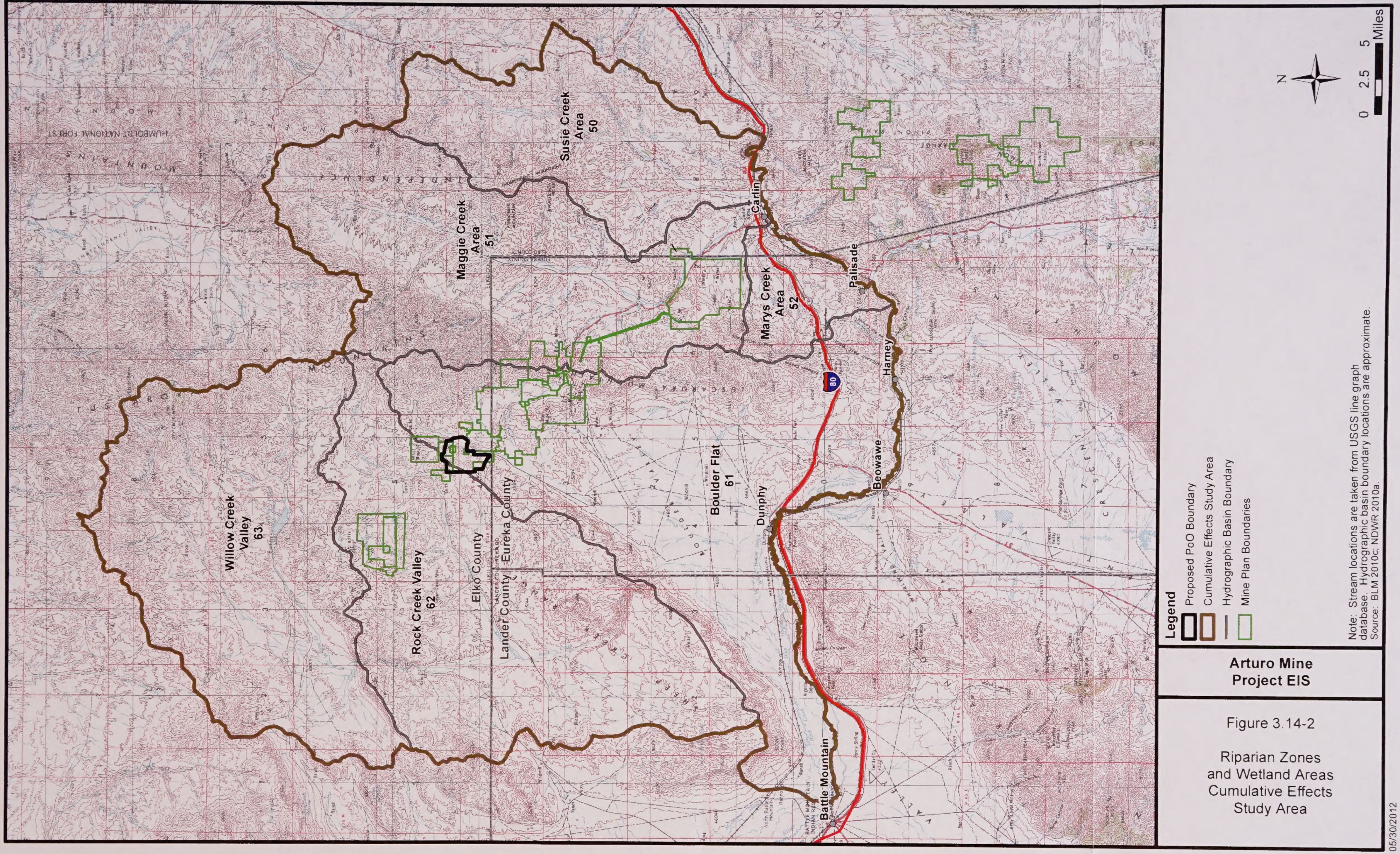
Source: BLM 2010c; USDA-NRCS 2011.

Arturo Mine Project EIS

Figure 3.14-1

Vegetation Cumulative Effects Study Area

05/24/2012



Legend

- ☐ Proposed PoO Boundary
- ☐ Cumulative Effects Study Area
- | Hydrographic Basin Boundary
- ☐ Mine Plan Boundaries

Arturo Mine
Project EIS

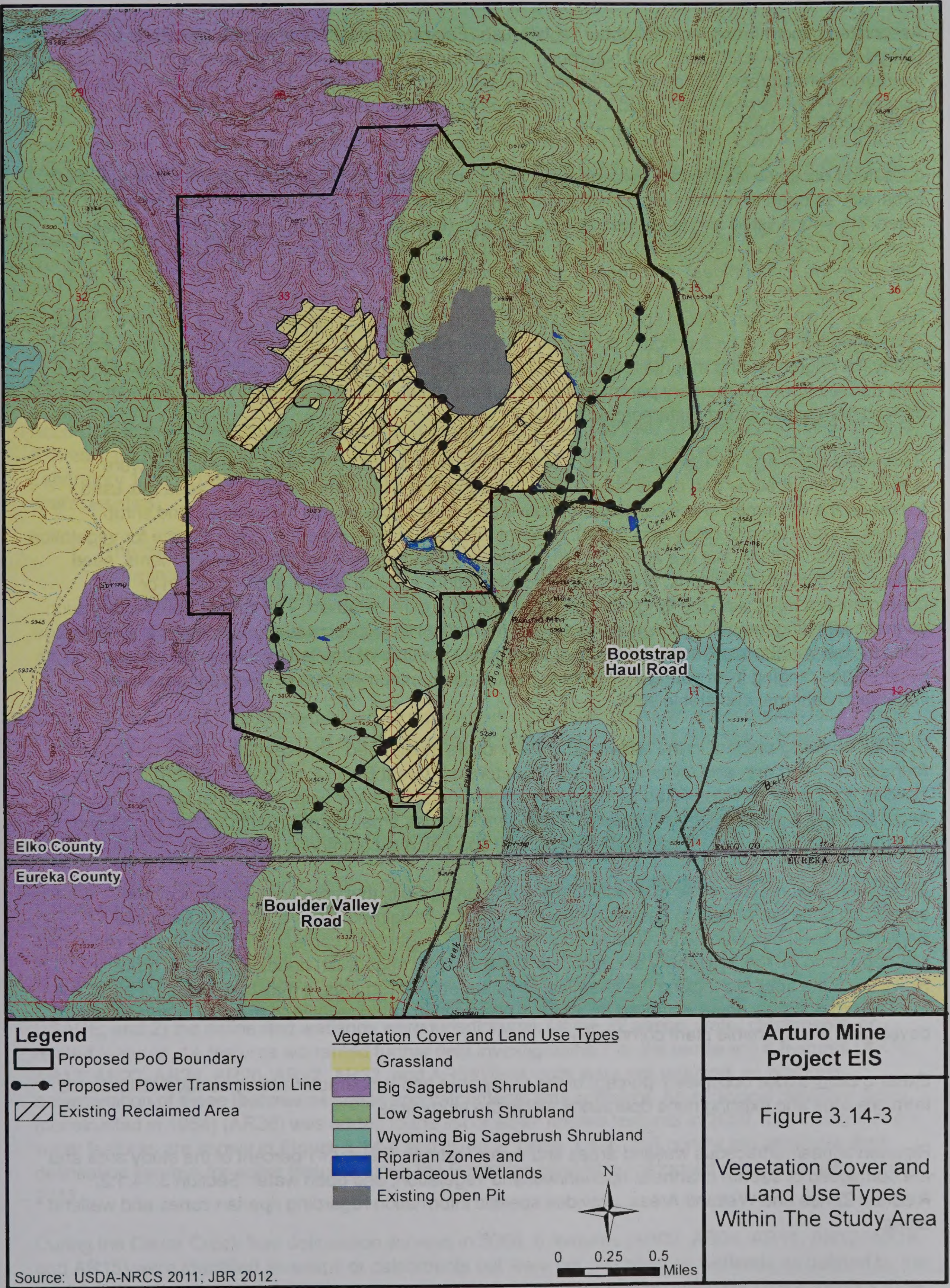
Figure 3.14-2

Riparian Zones
and Wetland Areas
Cumulative Effects
Study Area

Note: Stream locations are taken from USGS line graph database. Hydrographic basin boundary locations are approximate.
Source: BLM 2010c; NDWR 2010a.

05/30/2012

2012



Source: USDA-NRCS 2011; JBR 2012.

Arturo Mine Project EIS

Figure 3.14-3

Vegetation Cover and Land Use Types Within The Study Area

05/23/2012

Associated minor shrubs include rubber rabbitbrush (*Ericameria nauseosa*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), and bitterbush. Understory species consist of grasses and forbs including bluebunch wheatgrass, Sandberg bluegrass *Poa secunda*), cheatgrass (*Bromus tectorum*), bottlebrush squirreltail (*Elymus elymoides*), and lupine (*Lupinus* spp.). Soils associated with this vegetation cover type are typically deep, well-drained, and non-saline.

Grassland occupies less than 1 percent of the study area and is dominated by perennial grasses and forbs with an open to moderately dense shrub layer. Typical grass species include those used for reseeding efforts listed above, as well as basin wildrye (*Leymus cinereus*), bottlebrush squirreltail, bluegrass (*Poa* spp.), needlegrass (*Achnatherum* spp.), Sandberg bluegrass, Indian ricegrass (*Achnatherum hymenoides*), and cheatgrass (*bromus tectorum*). Forb species include long-leaf phlox (*Phlox longifolia*), sego lily (*Calochortus nuttallii*), royal penstemon (*Penstemon speciosus*), vetch (*Vicia* spp.), wild onion (*Allium* spp.), and tufted evening primrose (*Oenothera caespitosa*) (SRK 2009b). This vegetation cover type typically occurs on dry plains and mesas, deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. Substrates are often well drained sandy or loamy-textured soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks.

Reclaimed grassland occupies 19 percent of the study area and is composed of areas that were previously disturbed as part of the original Dee Mine that have been reclaimed. The seed mix used to reseed the reclaimed areas consisted of native and early successional herbaceous and shrub species (Great Basin Ecology, Inc. 2008). Several factors that determine the length of time for vegetation to re-establish include, but are not limited to, available moisture, plant nutritional requirements, seed availability, drought conditions, precipitation, soil condition, and soil chemical composition or characteristics determine the length of time for vegetation to re-establish. The benefit from factors such as these affecting the plant growth is the development of a mosaic vegetation pattern and a variable age class for the vegetation. A sustainable plant community consists of plants at various age classes and life cycle stages ranging from young immature to mature plants; reproduction of plants; a mosaic of vegetation patterns, and stable soils.

Species currently present in the reclaimed areas include those used for reseeding, native species not found in the seed mix, and invasive species (cheatgrass) (Great Basin Ecology, Inc. 2008). The typical species are similar to those listed for the grasslands vegetation cover type. Additional species include thickspike wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*), small burnet (*Sanguisorba minor*) and sagebrush (*Artemsia* spp.) Russian thistle (*Salsola* spp.) also is common in these areas.

Sagebrush requires a specific chemical in the soil to grow. Soils that contain this chemical and sagebrush seed were used to establish sagebrush on the reclaimed areas at the Dee Mine site. Sagebrush seed can also be inoculated prior to seeding. Sagebrush can establish rapidly at a reclaimed site depending on the availability of chemicals in the soil that sagebrush needs in order to grow. However, if the soils are lacking the chemicals that sagebrush requires, it may take years for sagebrush to establish or it may never establish on a site. Revegetation in the reclaimed areas was successful in developing a sustainable plant community.

Existing disturbance occupies 7 percent of the study area and is characterized by surface disturbance from previous and existing mine operations within the study area.

Riparian zones/herbaceous wetland areas and water features occupy <1 percent of the study area and are composed of stream channels, riparian/wetland vegetation, and open water. Section 3.14.1.2, Riparian Zones and Wetland Areas, provides specific information regarding riparian zones and wetland areas.

3.14.1.2 Riparian Zones and Wetland Areas

The study area for riparian zones and wetland areas is located in the Boulder Creek sub-basin of the Humboldt River drainage. The area is composed of rolling to moderately steep topography with ephemeral channels, seeps, springs, wetlands, and a sediment pond. Riparian zones and wetland areas in the region are characterized as herbaceous wetlands, seeps, catchments, and open water habitats (JBR Environmental Consultants, Inc. [JBR] 2012, 2009; Cedar Creek 2009). **Figure 3.14-4** illustrates riparian zones and wetland areas that occur in the study area.

The term wetland is defined in 33 Code of Federal Regulations 328, 7(b) as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Note that the frequency and duration of saturation may vary by geographical region and is largely dependent upon local climatic conditions. Wetlands adjacent to other waters of the United States, such as streams, also are considered to be waters of the United States.

According to the United States Army Corps of Engineers (USACE's) 1987 Wetland Delineation Manual, a three-parameter approach is required for delineating USACE-defined wetlands (Environmental Laboratory 1987). Based on this approach, areas are identified as wetlands if they exhibit the following characteristics:

1. The prevalence of vegetation consisting of hydrophytic species or plants that have the ability to grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content and depleted soil oxygen levels.
2. The presence of soils that are classified as hydric or possessing characteristics that are associated with reducing soil conditions. Hydric soils are poorly drained and have a seasonal high water table within 6 inches of the surface.
3. An area that is inundated either permanently or periodically at mean water depths less than or equal to 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

The USACE (Environmental Laboratory 1987) requires that, under normal circumstances, all three of these conditions be met for an area to be considered a wetland under the USACE's definition.

Additional guidance on wetlands is provided in the Interim Regional Supplement to the USACE Wetland Delineation Manual: Arid West Region (USACE 2006). Riparian and wetland areas were delineated within the study area based on a review of aerial photography and subsequent field surveys of potentially jurisdictional wetland and riparian features. In 2008, Cedar Creek reviewed previous aerial delineations to determine which of 22 seeps, water catchments, or related features warranted further field investigations to determine if: 1) any of the features would be classified as wetlands as defined by the USACE; and 2) the delineated wetlands were jurisdictional. Of the 22 seeps, water catchments, or related features, 14 features warranted further field investigations. For the remaining 8 features (AR10, AR13, AR22, AR24, AR26, AR32, AR33, and AR34) field visits were not required, as previous determination of these features as seeps and catchments was sufficient. An additional detention pond (constructed in 1964) (AR36) was added to the list of water related features in 2009. The location of the water features are shown in **Figure 3.14-4** and listed in **Table 3.4-2**. JBR conducted additional field delineation surveys for water features along the Bootstrap Haul Road proposed road expansion area in 2012.

During the Cedar Creek field delineation surveys in 2008, 6 features (AR02, AR04, AR11, AR12, AR14, and AR15) were identified as seeps or catchments but were not classified as wetlands as defined by the USACE. The results of the field delineations identified six areas exhibiting sufficient characteristics to be

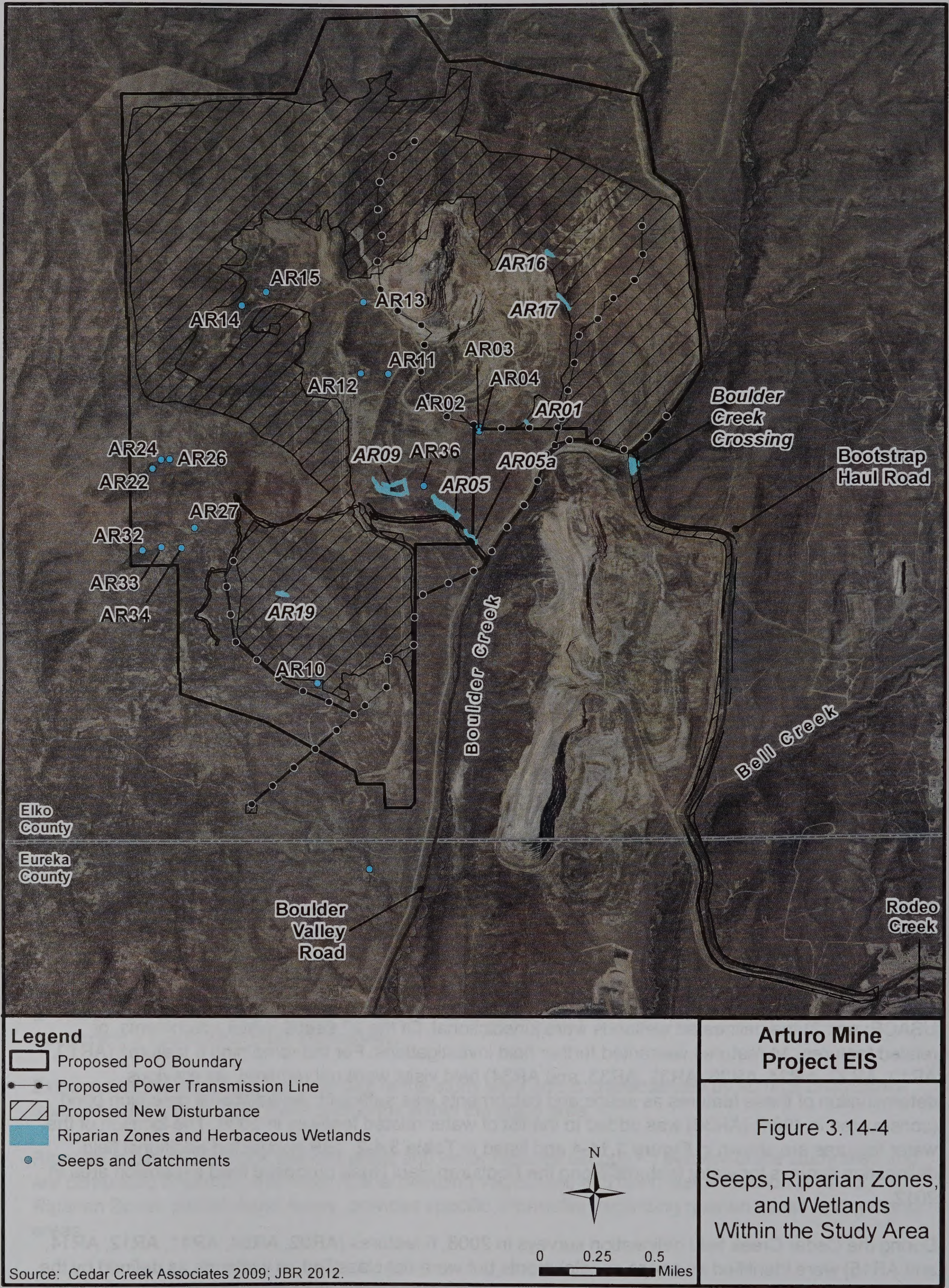


Figure 3.14-4

Seeps, Riparian Zones, and Wetlands Within the Study Area

Source: Cedar Creek Associates 2009; JBR 2012.

05/23/2012

classified as wetlands using USACE guidelines within the proposed PoO boundary (Cedar Creek 2009). One of the wetland areas can be divided into two identification areas, AR05 and AR05a. The results of the JBR 2012 field surveys identified two additional wetlands (on the north and south banks of the stream channel) of the Boulder Creek road crossing. The nine wetland areas and riparian zones within the study area are shown in **Table 3.14-2** and **Figure 3.14-4**.

Table 3.14-2 Riparian Zones and Wetland Areas Within the Study Area

Wetland ID	Location	Description	Acres
AR01	Isolated impoundment at the head of channel (affected by proposed project)	Wetland at the bottom of a drainage appears to have been translocated due to burial by a waste rock dump. Wetland flora observed includes meadow barley, rabbitfoot grass, and American speedwell.	0.06
AR05	Directly abuts channel	An associated wetland with AR05a is separated by a constructed sediment pond. Wetland due to upgradient seepage. Wetland flora observed includes broad-leaved cattail, Baltic rush, and American speedwell.	1.43
AR05a	Directly abuts channel	See description for AR05.	0.21
AR09	Impoundment at the head of channel	Constructed feature with sufficient inflows to develop wetland characteristics. Wetland flora observed includes American speedwell, meadow barley, foxtail barley, and curly dock.	2.01
AR16	Impoundment in channel (affected by proposed project)	Seep wetland appears to have been translocated due to burial by a waste rock dump.	0.25
AR17	Directly abuts channel (affected by proposed project)	Wetland at the bottom of a drainage appears to have been translocated due to burial by a waste rock dump. Wetland flora observed includes narrow-leaved cattail, foxtail barley, American speedwell, rabbitfoot grass, and hairy willowherb.	0.26
AR27	Isolated seep	Marginal wetland resulting from a natural seep flows into a low depression. Wetland flora observed includes annual hairgrass, blue vervain, curly dock, and poverty weed.	0.01
Boulder Creek Crossing 1 and 2	Stream channel with two associated wetlands (affected by the proposed project)	Riparian vegetation in the stream channel and associated wetlands on the north and south banks of Boulder Creek at the Boostrap Haul Road crossing. Wetland flora observed includes curly dock, rabbit's foot grass, and coyote willow.	1.06[1]
Total			**5.29**

[1] Total includes 0.7 acre of wetlands and 0.36 acre of riparian vegetation in the stream channel.

Source: BLM 2010b; Cedar Creek 2009; JBR 2012.

Typical species found in the wetlands along the ephemeral channels and more heavily vegetated portions of these wetlands include cattails (*Typha* spp.), meadow barley (*Hordeum brachyantherum*), and Baltic rush (*Juncus balticus*) (Cedar Creek 2009). Species that typically occur in the seeps and more sparsely vegetated wetlands are curly dock (*Rumex crispus*), annual rabbit's-foot grass (*Polypogon monspeliensis*), and other early successional wetland taxa (Cedar Creek 2009). Of the seven wetlands identified in the proposed PoO boundary, five abut ephemeral channels and two are isolated wetlands (JBR 2009). Most of the wetlands cover an area less than 1 acre. Only two wetlands are larger than 1 acre, with the largest mapped wetland being approximately 2 acres. Seeps that occur within the proposed PoO boundary are associated with either historic sediment and runoff control features or occur at the base of waste rock facilities or other features that had developed in relation to mine activities (Cedar Creek 2009). The wetlands identified along the Bootstrap Haul Road crossing are associated with Boulder Creek which was confirmed not to be a tributary of the Humboldt River. The wetlands cover less than 1 acre (0.70 acres) (JBR 2012).

Of the ephemeral stream channels in the project area, 5 do not extend beyond the project area, while 10 are tributaries of Boulder Creek (JBR 2009). Boulder Creek was confirmed to not be a tributary of Humboldt River as it dissipates approximately 17 stream miles downgradient of the project area (JBR 2009).

A delineation of jurisdictional waters (i.e., defined creek channels and wetlands) was conducted in the project PoO boundary, and along Boulder Creek from Boulder Valley Road to Rock Creek Ditch in August and September 2009 (JBR 2009). The results of the field investigations and a request for an approved jurisdictional determination were provided to the Sacramento District Office of the USACE in November 2009. The USACE provided a jurisdictional determination to Barrick Dee Mining Venture (BDMV) on August 13, 2010, for the proposed PoO boundary. The USACE determined that Channels 1, 2, 3, 4, 5, 6a, 6b, 6, 7, 8a, 8b, 8c, 8d, 8e, 8; East and West Swales; wetlands; and springs within the proposed PoO boundary are intrastate isolated waters with no apparent interstate or foreign commerce connection and, thus, not currently regulated by the USACE under Section 404 of the Clean Water Act (USACE 2010). The disturbance to widen the Bootstrap Haul Road will be less than 1 acre. The Bell Creek crossing will not require additional width as the road is sufficiently wide enough to accommodate haul road traffic. Boulder and Bell creeks also were determined by the USACE to be non-jurisdictional. The results of the April 2012 field surveys were not provided to the USACE. However, as Boulder Creek was determined to be non-jurisdictional, its associated wetlands are also non-jurisdictional. Therefore, the proposed project would not be required to obtain a USACE permit to proceed with project implementation.

3.14.2 Environmental Consequences

Primary issues related to vegetation resources include loss or degradation of upland and riparian/wetland vegetation communities. The potential impacts of the proposed project on vegetation can be classified as short-term (temporary) and long-term duration. Short-term impacts result from surface disturbances related to construction, operation and interim and final reclamation activities. Short-term impacts would cease upon mine closure and completion of successful reclamation. Long-term impacts consist of permanent changes to vegetation communities, irrespective of reclamation success.

3.14.2.1 Proposed Action

General Vegetation

Under the proposed project, mine development and operation would disturb approximately 2,774 acres from surface disturbance activities. Approximately 269 acres would occur in areas of existing disturbance, 543 acres would occur in previously disturbed but reclaimed areas, and 1,962 acres would occur in previously undisturbed areas. The majority of the disturbance would occur in the sagebrush shrubland type, upland areas, and/or areas previously disturbed by historical mining activities.

Table 3.14-3 lists the vegetation cover and land use types and acreages that would be disturbed from project construction and operation. Acres of vegetation impacted by geologic exploration activities were estimated by multiplying the percent of the area impacted by geologic exploration activities by the acreage of each vegetation type within the proposed PoO boundary. In addition, vegetation along existing access roads would be affected (e.g., reduction in growth rate) as a result of additional dust deposition.

Table 3.14-3 Proposed Action – Disturbed Acres of General Vegetation Cover and Land Use Types, and Specific Vegetation Types

General Vegetation Cover and Land Use Types	Specific Vegetation Types	Acres	Percent of Study Area
New Disturbance			
Grassland	--	<1	<1
Sagebrush Shrubland	Low Sagebrush Shrubland	1,396	50
	Big Sagebrush Shrubland	542	20
	Wyoming Big Sagebrush	22	<1
Riparian Zones and Herbaceous Wetland Areas[1]	--	2	<1
Previously Disturbed but Reclaimed			
Reclaimed Grasslands	--	543	20
Existing Disturbance			
Existing Disturbance	--	269	10

[1] Detail in **Table 3.14-4**.

Source: Cedar Creek 2009; JBR 2012; USDA-NRCS 2010a,c.

The goals of reclamation include providing a stable post-mining landform that supports defined land uses, such as wildlife habitat and domestic grazing; minimizing erosion damage and protecting water resources through control of water runoff and stabilization of components; establishing post-reclamation surface soil conditions conducive to the regeneration of a stable plant community; and revegetating disturbed areas with a diverse mixture of plant species in order to establish productive long-term plant communities compatible with existing land uses.

Project-related activities would result in the conversion of a shrub-dominated vegetation cover type to a grass/forb dominated vegetation cover type in the short term. Over the long term, shrubs would become re-established and increase in abundance within the majority of disturbed areas as a result of reclamation and natural re-colonization. The loss of 1,960 acres of shrub-dominated vegetation would represent a long-term impact as it could take up to 25 years following reclamation for mature shrub species to re-establish.

To minimize impacts to vegetation, reclamation would be conducted as soon as practical, with concurrent reclamation implemented to the maximum extent possible as discussed in Section 2.3.8, Closure and Reclamation Plan. Reclamation activities would include, but would not be limited to, grading of final slopes; ripping of compacted soil; application of growth media; and broadcasting of seed. Interim seed mixes, as described in **Appendix A**, **Table A-3**, would be used for concurrent reclamation during project operations. The final reclamation mix to be used for revegetation activities post-operations is provided in **Appendix A**, **Table A-1**. The interim seed mix uses three species that stabilize areas quickly, while the reclamation seed mix consists of a variety of native grasses, forbs, and shrubs to revegetate disturbed areas. Satisfactory revegetation of mine-related disturbance areas (i.e., assuming the primary goal of soil stabilization through presence of adequate plant cover) is anticipated to occur approximately 3 to 15 years following reclamation. After 25 years, the reclaimed plant communities likely would consist of adequate herbaceous plant cover with sufficient diversity to substantially reduce the potential for soil erosion and provide suitable forage for livestock and wildlife.

Riparian Zones and Wetland Areas

The potential impacts of the proposed project on riparian zones and wetland areas would predominantly be considered long-term. Long-term impacts consist of permanent changes to wetland and riparian zones irrespective of post-closure and reclamation success. Impacts to wetlands would result from surface disturbances; changes in surface water and groundwater flows; and the removal of water sources related to construction, operation, and reclamation activities. The construction of the open pit would affect three wetlands (0.54 acre) (**Table 3.14-4**). The widening and realigning of the Bootstrap Haul Road would disturb 0.7 acres of wetlands and 0.36 acres of riparian vegetation in the stream channel at the Boulder Creek Crossing. The construction of the proposed pit wall and the proposed Heap Leach Pad No. 12 would result in the removal of several seeps either through direct impacts to the seep or the removal of the water source seeps, see Section 3.4, Water Resources and Geochemistry.

Indirect impacts to wetland areas as a result of soil erosion and sedimentation would be minimized with the implementation of erosion control measures as described in Section 2.3.9, Applicant-committed Environmental Protection Measures.

Table 3.14-4 Proposed Action – Disturbed Acres of Wetlands within the Study Area

Wetland ID	Acres
AR01	0.06
AR16	0.25
AR17	0.26
Boulder Creek Riparian Zones and Wetland Areas	1.06
Total	**1.63**

Source: Cedar Creek 2009; JBR 2012.

3.14.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance.

General Vegetation

Table 3.14-5 lists the vegetation cover and land use types and acreages that would be disturbed from the proposed Single WRDF Alternative construction and operation. Acres of vegetation impacted by geologic exploration activities were estimated by multiplying the percent of the area impacted by geologic exploration activities by the acreage of each vegetation type within the proposed PoO boundary. In

Table 3.14-5 Single WRDF Alternative – Disturbed Acres of General Vegetation Cover and Land Use Types, and Specific Vegetation Types

General Vegetation Cover and Land Use Types	Specific Vegetation Types	Acres	Percent of Study Area
New Disturbance			
Grassland	--	<1	<1
Sagebrush Shrubland	Low Sagebrush Shrubland	1,250	1
	Big Sagebrush Shrubland	560	47
	Wyoming Big Sagebrush	22	21
Riparian Zones and Herbaceous Wetland Areas[1]	--	2	<1
Previously Disturbed but Reclaimed			
Reclaimed Grasslands	--	543	21
Existing Disturbance			
Existing Disturbance	--	269	10

[1] Detail in **Table 3.14-4**.

Source: Cedar Creek 2009; JBR 2012; USDA-NRCS 2010a,c.

addition, vegetation along existing access roads would be affected (e.g., reduction in growth rate) as a result of additional dust deposition.

The acres of proposed disturbance in areas of existing disturbance, and previously disturbed but reclaimed areas would be similar to the Proposed Action. Approximately 1,834 acres of vegetation in previously undisturbed areas would be disturbed by surface disturbance activities. There would be a long-term loss of 1,832 acres of shrub-dominated vegetation until reclamation has been completed and vegetation is reestablished.

Riparian Zones and Wetland Areas

Under the Single WRDF Alternative, impacts to riparian zones and wetland areas would be the same as the Proposed Action.

3.14.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would be similar to the Proposed Action except that mining would be sequenced to allow backfilling portions of the open pit with waste rock during mining. The surface facilities and footprint for this alternative are identical to the Proposed Action. While the surface disturbance would be the same under this alternative as the Proposed Action, there are differences in the design height and capacity of the West and East WRDF, the amount of area to be reclaimed, and the surface area and locations of the final pit lakes.

General Vegetation

Under the Partial Pit Backfill Alternative, surface disturbance would be the same as described for the Proposed Action, except that during final reclamation, 291 additional acres would be reclaimed within the open-pit footprint as compared to the Proposed Action.

Riparian Zones and Wetland Areas

Under the Partial Pit Backfill Alternative, surface disturbance would be the same as described for the Proposed Action.

3.14.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to vegetation resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, ongoing mineral exploration activities, and reclamation within the study area, would be conducted under existing authorizations. No additional ground-disturbing activities beyond those currently authorized would occur at the mine site.

3.14.3 Cumulative Impacts

The CESA for vegetation resources and riparian zones and wetland areas is defined in Section 3.14.1, Affected Environment, and is shown in **Figures 3.14-1** and **3.14-2**, respectively. Past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1** and their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.14.3.1 Proposed Action

General Vegetation

Additional vegetation types that occur in the CESA but do not occur in the study area include salt-desert shrubland, greasewood shrubland, sagebrush shrubland, mountain big sagebrush, and wet meadow. Past, present, and RFFAs in the vegetation CESA have resulted, or would result, in approximately 36,455 acres of mine-related disturbance. Past, present, and RFFAs from utility and energy development (North Elko Pipeline and TS Power Plant) have resulted, or would result, in up to 740 acres of additional disturbance. The proposed project incrementally would increase disturbance by an additional 1,962 acres for a total cumulative disturbance of 39,157 acres. The proposed project disturbance represents approximately 5 percent of the total past, present, and RFFAs disturbance. It is assumed that portions of past mine-related disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue. The incremental additional impacts to vegetation as a result of the proposed project would be temporary in nature for the majority of the project disturbance area, with the exception of the open pit, which would not be reclaimed.

Other surface disturbing activities in the CESA that contribute to cumulative effects of vegetation resources include the establishment and spread of noxious weeds and non-native invasive plant species, livestock grazing, and wildfires. Cumulative impacts to vegetation resources within the CESA are discussed specifically in the Leeville Project, Final Supplemental EIS (BLM 2010b).

Cumulative losses for vegetation resources potentially would include the reduction of native ecosystem functions such as soil stability, erosion control, livestock and wildlife forage, and wildlife habitat. The removal of woody species from these areas would result in a long-term change in vegetation structure since it may take up to 15 to 20 years for shrub species of similar stature to become re-established in these areas. Indirect impacts to vegetation resources associated with surface disturbance activities would include fugitive dust accumulation, and introduction and/or spread of noxious weeds and non-native invasive plant species. Fugitive dust from development activities can adversely impact native vegetation communities and alter vegetative composition (U.S. Fish and Wildlife Service 2008a). The cumulative effects of noxious weeds and non-native invasive plant species are discussed in Section 3.15, Noxious Weeds and Non-native Invasive Plant Species.

Livestock grazing has and would continue to influence vegetation composition and structure throughout the CESA. Potential for overgrazing may increase as land is converted to mining and transportation uses or land that is temporarily lost to wildfire; however, adjustment of stocking rates to account for changes in land use ensures vegetation communities are not overgrazed. Within the CESA, reductions in permitted grazing use would continue to occur as a result of mine development and wildfires; however, these impacts would be short-term as subsequent reclamation of mined areas and restoration of burned sites would allow for stocking rates to return to near pre-mining/pre-burn levels.

Numerous wildfires have occurred in the study area, creating additional regional impacts to vegetation within the CESA. **Figure 3.2-3** illustrates the locations of the wildfires in the region over the past 30 years. The cumulative effect of fires within the CESA is more pronounced because of the increased size and intensity of recent wildfires. Direct and indirect impacts to vegetation resources from wildfires include the complete loss or partial removal of upland vegetation species, potential removal of below ground biomass, soil hydrophobicity, and the potential spread and/or introduction of noxious weeds and non-native invasive plant species. See Section 3.13.3.1, Proposed Action, for a further discussion of the effects of wildfires on soil resources. The general effect in some areas from recent fires included the conversion of sagebrush habitat to cheatgrass, which form a persistent, non-native, monoculture that tends to dominate burned areas. The continued establishment of cheatgrass would increase the likelihood of wildfire, and could change the fire regime, community composition, and structure of plant communities indefinitely. Impacts to vegetation resources may vary depending on fire intensity, duration, and frequency. Recovery timeframes for herbaceous and woody species would be relatively similar to those previously described for other surface disturbance-related activities. Reseeding would improve vegetation structure and composition in burned areas and would benefit wildlife by providing forage, cover, and nesting habitat. Large areas affected by fire may take years to reestablish native vegetation. Completed and planned sagebrush and forage planting in burned areas would benefit a diversity of wildlife species including mule deer, pronghorn, sage grouse, and pygmy rabbit by providing forage, cover, and breeding habitat.

Reclamation of mine-related disturbances in the CESA would be incremental as various operations reach the end of active mining and begin closure activities. In many of the mines, permanent disturbance would be associated with the open pits that would not be reclaimed; some would be partially filled with water. Areas being reclaimed on public lands would be reclaimed to BLM standards and monitored to assess success of reclamation. Grasses with low densities of native forbs and shrubs would likely be the dominant vegetation on reclaimed areas.

Previously disturbed land has been reclaimed with a seed mix consisting of native grasses, forbs and shrubs. Currently, these reclaimed areas maintain a diverse plant community that is self-sustaining and resistant to erosion. The dominant plants within these reclaimed areas are basin wildrye, bluebunch wheatgrass, black sagebrush (*Artemisia nova*), Wyoming big sagebrush, and cheatgrass (*Bromus tectorum*) (Great Basin Ecology, Inc. 2008, SRK 2009b,c and BLM 2010b). Communities of big sagebrush, the most extensive pre-mining plant community, have proven difficult to re-establish on reclaimed lands when the soil characteristics do not contain the specific chemicals required by sagebrush to establish and grow (BLM 2010b).

Past, present, and RFFAs would cumulatively and incrementally reduce vegetation cover types until such time that reclamation is deemed successful and native plants are re-established. Although the cumulative surface disturbance would be greater than the proposed project disturbance, it would represent a small increment of the vast acreage of public lands in the area, and would have minimal effect on land uses displaced by past, present, and RFFAs in the CESA. The cumulative unreclaimed disturbance area that would remain after completion of the interrelated actions, including the pit areas of the proposed project, would be a small percentage of the total land area in the CESA, and would have a negligible effect on land uses. The loss of mature shrubs would be minimal relative to the total acreage of woody species communities that occur within the CESA.

Riparian Zones and Wetland Areas

Surface disturbing activities in the CESA that have resulted, or would result, in cumulative effects to riparian zones and wetland areas include wildfires, mining operations, utility and energy development, and agricultural activities. Within the CESA, impacts to riparian zones and wetland areas are discussed in the NEPA documents associated with the past and current projects (BLM 2010b, 2008b, 2007a, 2000b). Cumulative impacts to riparian zones and wetland areas within the Carlin Trend are discussed in the Leeville Project, Final Supplemental EIS (BLM 2010b). Cumulative impacts to riparian zones and wetland areas cannot be quantified but are discussed qualitatively.

A total of 4,530 acres of riparian/wetland habitat occur within the CESA; including 2,218 acres in Maggie Creek, 1,685 acres in Rock Creek (including Boulder Flat), 228 acres in Susie Creek, 388 acres in Humboldt River watersheds and 10 acres associated with small tributaries to the Humboldt River (BLM 2010b).

It is anticipated that the cumulative impacts to riparian zones and wetland areas in the Carlin Trend from past, present, and RFFAs would include degradation of riparian and wetland vegetation from livestock grazing; mining (surface disturbance and dewatering activity); conversion of native riparian/wetland plant communities to communities dominated by invasive non-native species; other industrial development (e.g., power plants and power transmission corridors); service roads; wildfire; and in some cases agricultural diversions (BLM 2010b). These activities may result in the temporary or permanent loss of riparian and wetland vegetation. Wildfires have had varying impacts on riparian and wetland habitats, depending on the condition and moisture levels of the riparian zone prior to the wildfire. Grazing has affected and will continue to affect riparian zones and wetland areas to varying degrees. Depending on the level of management, livestock grazing may have minimal to extensive impacts on riparian vegetation. Grazing in the annual hot season, combined with the establishment of noxious weeds and non-native invasive plant species has an increased potential for impacts to riparian and wetland resources through loss of habitat and decrease and/or loss of vegetation.

Over the last several decades, riparian zones have generally improved throughout portions of the study area in response to changes in livestock management. As the need and opportunity for further grazing management changes are identified and implemented, riparian zones are expected to continue to improve. Although some impacts due to dewatering have occurred, riparian zones and wetland areas have been improved and expanded in the CESA, through the Maggie Creek Watershed Restoration Project and Upper Willow Creek Habitat Enhancement Plans (BLM 2010b).

Under the proposed project the loss of the five wetlands and the portion of Boulder Creek riparian vegetation in the stream channel within the Bootstrap Haul Road expansion area (1.6 acres) would be a small but incremental addition to cumulative impacts to riparian zones and wetland areas within the CESA.

3.14.3.2 Single Waste Rock Disposal Facility Alternative

General Vegetation

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action, except that this alternative would incrementally add approximately 1,834 acres to the disturbance for a total cumulative disturbance of 39,029 acres. The Single WRDF Alternative disturbance represents approximately 5 percent of the total. Cumulative impacts to vegetation resources would be the similar to those described for the Proposed Action minus 128 acres of vegetation impacts from surface disturbance.

Riparian Zones and Wetland Areas

Cumulative effects under the Single WRDF Alternative would be the same as discussed under the Proposed Action.

3.14.3.3 Partial Pit Backfill Alternative

General Vegetation

Cumulative effects under the Partial Pit Backfill Alternative would be the same as discussed under the Proposed Action, except that an additional 291 acres would be reclaimed in the open pit during final reclamation.

Riparian Zones and Wetland Areas

Cumulative effects under the Partial Pit Backfill Alternative would be the same as discussed under the Proposed Action.

3.14.3.4 No Action Alternative

General Vegetation

Under the No Action Alternative, the proposed project would not be developed and no additional cumulative effects to vegetation resources would occur.

Riparian Zones and Wetland Areas

Under the No Action Alternative, the proposed project would not be developed and no additional cumulative effects to riparian zones and wetlands areas would occur. Cumulative impacts to riparian zones and wetland areas associated with past and current projects were identified in previous NEPA analyses in the area (BLM 2010b, 2008b, 2007a, 2000b).

3.14.4 Potential Monitoring and Mitigation Measures

3.14.4.1 General Vegetation

The following mitigation measures are recommended for vegetation resources.

Issue: Sagebrush is an important habitat in the study area, and the loss of sagebrush communities would have impacts on area wildlife. Sagebrush communities can take several decades to reclaim and often be unsuccessful without additional reclamation measures.

Mitigation Measure V-1: Additional reclamation measures would be implemented to assist in the reclamation of sagebrush shrubland communities in the PoO boundary. Additional reclamation measures to be implemented include:

- Application of mulch;
- Inoculation with arbusucular mychorrizea;
- Reduced seeding rate of grasses and forbs in the reclamation seed mixes to reduce competition;
- Growth media would be direct-placed, when possible; and
- Planting of sagebrush in small patches.

Effectivness: The implementation of the additional sagebrush measures would assist in the establishment of successful sagebrush communities by favoring the establishment of big sagebrush in the PoO boundary. Big sagebrush would be favored by decreasing competition with herbaceous species and noxious weeds, and the amelioration of site conditions through the addition of mulch, inoculation with arbusucular mychorrizea.

3.14.4.2 Riparian Zones and Wetland Areas

The following mitigation measures are recommended for riparian zones and wetland areas.

Issue: Development of the proposed project would affect 12.6 acres of riparian and wetland vegetation.

Mitigation Measure W-1: In order to offset project-related impacts that would remove or disturb approximately 1.6 acres of riparian zones and wetland vegetation, BDMV would install BLM-approved fencing around approximately 34 acres of vegetation, including three springs, located within the Water Canyon spring complex area (located in Section 12, Township 34N, Range 45E), in coordination with the BLM.

In March 2011, a Class III cultural resources inventory was conducted within the Water Canyon spring complex area to determine whether the installation of the fence would result in cultural impacts. The Class III inventory recorded three new prehistoric lithic scatter locations that are not eligible for the National Register of Historic Places.

Effectiveness: Implementation of this mitigation measure would offset project-related impacts to wetland vegetation by preventing livestock use within the fenced Water Canyon spring complex, enhancing and restoring existing wetland areas within the project region.

3.14.5 Residual Impacts

3.14.5.1 General Vegetation

Residual impacts to vegetation would include the permanent loss of 472 acres of vegetation in previously reclaimed or undisturbed areas associated with the expansion of the open pit, which would not be reclaimed. Under the proposed project, the loss of shrub-dominated communities would represent a long-term change in vegetation composition (i.e., shrub-dominated communities to grass/forb-dominated communities). In addition, fragmentation and the conversion of vegetation types may occur over the long term, depending on the success of reclamation and associated disturbances during the life of the project.

3.14.5.2 Riparian Zones and Wetland Areas

Residual impacts to riparian zones and wetland areas would be mitigated through implementation of Mitigation Measure W-1. Therefore, there would be no residual impacts to riparian zones and wetland areas.

3.15 Noxious Weeds and Non-native Invasive Plant Species

The study area for noxious weeds and non-native invasive plant species includes the proposed Plan of Operations (PoO) boundary; and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and power transmission line corridor that occur outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for noxious weeds and non-native invasive plant species covers the four grazing allotments (Twenty Five, Boulder Field, T Lazy S, and Marys Mountain) located on the Carlin Trend in the vicinity of the study area and the Boulder Creek Valley area between the T Lazy S and Twenty Five Grazing Allotment (**Figure 3.15-1**).

3.15.1 Affected Environment

Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 United States Code (USC) SS 2801-2814]), a noxious weed is defined as “any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.” The State of Nevada also regulates noxious weeds. Under the Nevada Revised Statute (NRS), a noxious weed is defined as “any species of plant which is, or is likely to be, detrimental or destructive and difficult to control or eradicate” (NRS 555.005 – Control of insects, pests, and noxious weeds). Noxious weeds have become a growing concern in Nevada, based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. Noxious weeds are classified into three categories based on the statewide importance, distribution, and the ability of eradication or control measures to be successful. Category A weeds are not currently found or have limited distribution throughout the state and eradication and control is required by the state, in all infestations; Category B weeds are found in scattered populations in some counties of the state; and control is required by the state in areas where populations are not well established or previously unknown to occur; and Category C weeds are currently established and generally widespread in many counties of the state and control is at the discretion of the state quarantine officer (NRS 555.010). A list of the noxious weed species designated by the state is provided in **Table 3.15-1**.

Table 3.15-1 State of Nevada Noxious Weeds

Common Name	Scientific Name	Category[1]
African rue	*Peganum harmala*	A
Austrian fieldcress	*Rorippa austriaca*	A
Austrian peaweed	*Sphaerophysa salsula/Swainsona salsula*	A
Black henbane	*Hyoscyamus niger*	A
Camelthorn	*Alhagi camelorum*	A
Common crupina	*Crupina vulgaris*	A
Dalmation toadflax	*Linaria dalmatica*	A
Dyer’s woad	*Isatis tinctoria*	A
Eurasian water-milfoil	*Myriophyllum spicatum*	A
Giant reed	*Arundo donax*	A
Giant salvinia	*Salvinia molesta*	A
Goats rue	*Galega officinalis*	A
Green fountain grass	*Pennisetum setaceum*	A
Houndstongue	*Cynoglossum officinale*	A
Hydrilla	*Hydrilla verticillata*	A
Iberian starthistle	*Centaurea iberica*	A

Table 3.15-1 State of Nevada Noxious Weeds

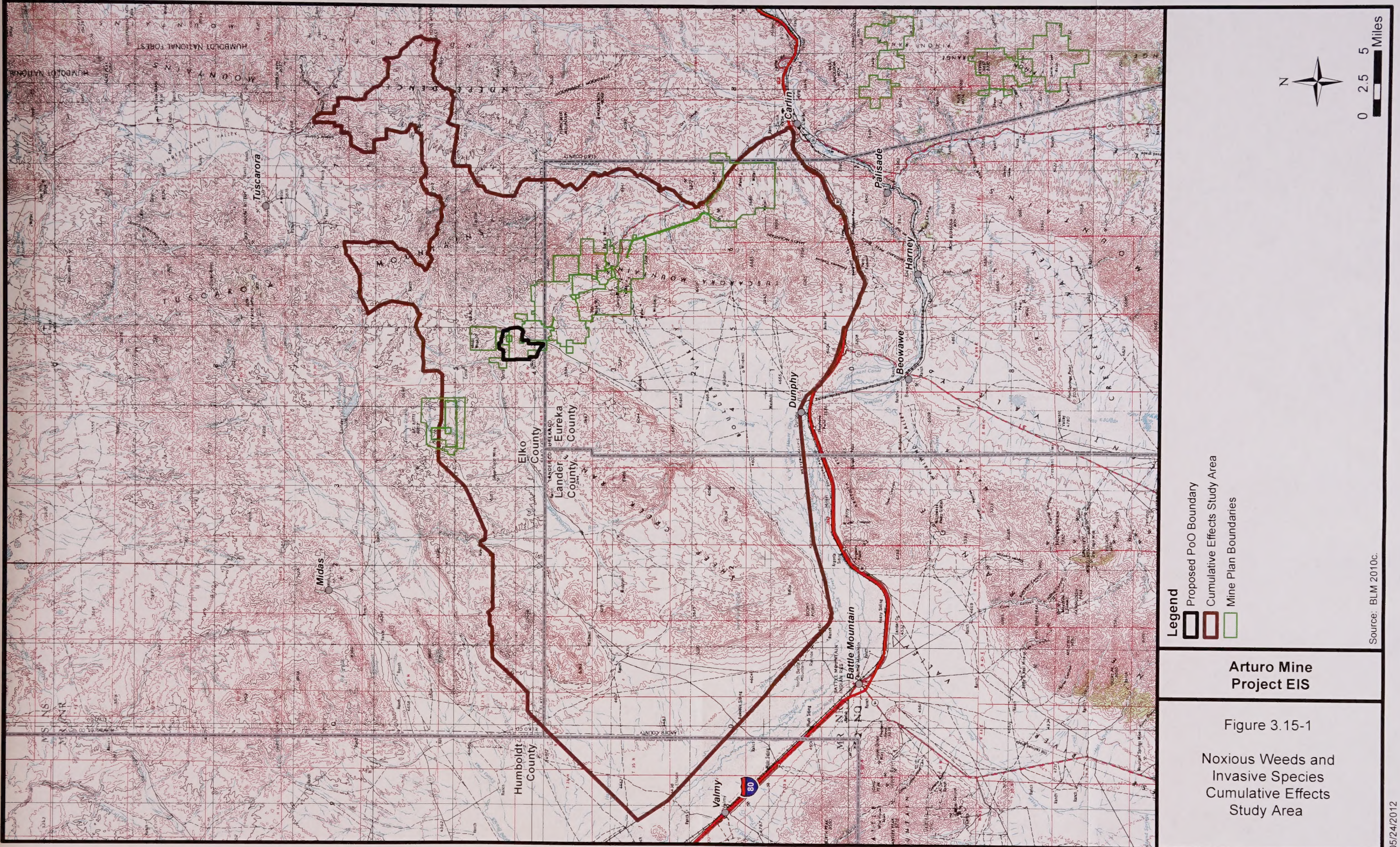
Common Name	Scientific Name	Category[1]
Klamath weed	*Hypericum perforatum*	A
Malta star thistle	*Centaurea melitensis*	A
Mayweed chamomile	*Anthemis cotula*	A
Mediterranean sage	*Salvia aethiopis*	A
Purple loosestrife	*Lythrum salicaria, L. virgatum* and their cultivars	A
Purple star thistle	*Centaurea calcitrapa*	A
Rush skeletonweed	*Chondrilla juncea*	A
Sow thistle	*Sonchus arvensis*	A
Spotted knapweed	*Centaurea masculosa*	A
Squarrose knapweed	*Centaurea virgata*	A
Sulfur cinquefoil	*Potentilla recta*	A
Syrian bean caper	*Zygophyllum fabago*	A
Yellow star thistle	*Centaurea solstiltialis*	A
Yellow toadflax	*Linaria vulgaris*	A
Carolina horse-nettle	*Solanum carolinense*	B
Diffuse knapweed	*Centaurea diffusa*	B
Leafy spurge	*Euphorbia esula*	B
Medusahead	*Taeniatherum caput-medusae*	B
Musk thistle	*Carduus nutans*	B
Russian knapweed	*Acroptilon repens*	B
Sahara mustard	*Brassica tournefortii*	B
Scotch thistle	*Onopordum acanthium*	B
White horse-nettle	*Solanum elaeagnifolium*	B
Canada thistle	*Cirsium arvense*	C
Hoary cress	*Cardaria draba*	C
Johnson grass	*Sorghum halepense*	C
Perennial pepperweed	*Lepidium latifolium*	C
Poison hemlock	*Conium maculatum*	C
Puncture vine	*Tribulus terrestris*	C
Salt cedar (tamarisk)	*Tamarix* spp.	C
Water hemlock	*Cicuta maculata*	C

[1] **Category A** includes noxious weeds, which are: 1) not found or limited in distribution throughout the state; 2) actively excluded from the state and actively eradicated wherever found; and 3) controlled by the state for all infestations.

Category B includes noxious weed species, which are: 1) established in scattered populations in some counties of the state; 2) actively excluded where possible; and 3) controlled by the state in areas where populations are not well established or previously unknown to occur.

Category C includes noxious weeds, which are: 1) currently established and generally widespread in many counties of the state; and 2) controlled and abated at the discretion of the state quarantine officer.

Source: Nevada Department of Agriculture 2006.



Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.15-1

Noxious Weeds and Invasive Species Cumulative Effects Study Area

05/24/2012

In addition, the federal Noxious Weed Act of 1974, as amended (7 USC 2801 et seq.) requires cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Recognizing these regulations, the Bureau of Land Management (BLM) requires that National Environmental Policy Act documents consider and analyze the potential for the spread of noxious weed species and provide preventative rehabilitation measures for each management action involving surface disturbance. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, they usually have no natural enemies to limit their reproduction and spread (Westbrooks 1998).

Within the proposed PoO boundary where existing disturbance has occurred, scotch thistle, salt cedar, and bull thistle have been visually observed during pedestrian surveys of the site (BLM 2010b; SRK 2009b,c). Scotch thistle populations are most prominent and occur throughout the existing disturbance area, including exploration roads. Control measures for this species have been and are currently being implemented in order to control or eradicate this species. Salt cedar populations are limited to Tailing Impoundment #2. Control measures for this species have been implemented and proven successful. Bull thistle and hoary cress populations generally occur along the periphery of the constructed wetlands areas. Hoary cress populations also have been observed along the exploration roads. While not a federal or state-designated noxious weed, cheatgrass (*Bromus tectorum*) has been observed in the existing disturbance area and is considered a non-native invasive plant species.

Dee Gold Mining Company has a noxious weed control program that has been actively treating noxious weeds at the existing Dee Mine. The noxious weed control program includes annual monitoring and herbicide and mechanical treatments, such as hand pulling.

3.15.2 Environmental Consequences

Primary issues related to noxious weeds and non-native invasive plant species include direct and indirect impacts associated with the introduction or spread of noxious weeds and non-native invasive plant species resulting in the loss or degradation of native vegetation communities, or preferred grazing areas.

3.15.2.1 Proposed Action

Under the proposed project, mine development and operation would disturb approximately 2,774 acres from surface disturbance activities. Approximately 269 acres would occur in areas of existing disturbance, 543 acres would occur in previously disturbed but reclaimed areas, and 1,962 acres would occur in previously undisturbed areas. The majority of the disturbance would occur in the sagebrush shrubland type.

Following surface disturbance activities, noxious weeds and non-native invasive plant species may readily colonize areas that typically lack or have minimal vegetation cover. It is anticipated that minor populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time. Surface disturbance and increased vehicle travel along new routes may readily spread noxious weeds and non-native invasive plant species and colonize areas that have minimal vegetative cover or that have been recently disturbed. Noxious weed species can degrade and modify native communities, reduce resources for native species, monopolize limited sources of moisture, and adversely affect native pollinators. In addition, noxious weeds and non-native invasive plant species can reduce wildlife habitat, alter fire regimes, and degrade wetland and riparian areas.

Implementation of the applicant-committed environmental protection measures, and Barrick Dee Mining Venture's (BDMV) Reclamation Plan and Weed Management Plan would reduce the potential for noxious weeds and non-native invasive plant species establishment in the study area. All surface disturbance would be reclaimed either concurrently during operations as areas become available or once mining is complete. The Weed Management Plan includes management strategies and control techniques to prevent or minimize the establishment or spread of weed populations. Noxious weed management would continue during the post-mining reclamation period and the post-closure monitoring period.

BDMV would implement Best Management Practices to prevent the spread of noxious weeds, which would include seeding growth media stockpiles as soon as practical with an interim seed mix (**Appendix A**, **Table A-3**); using certified weed-free hay and straw; and reclaiming with an approved seed mix (**Appendix A**, **Table A-1**). Seeding the growth media stockpiles with the interim seed mix would stabilize the growth media and reduce soil erosion in addition to minimizing the potential for the establishment of noxious weeds and non-native invasive plant species. Successful reclamation of mine-related disturbance areas (except for the open-pit) would result in the establishment of a permanent vegetative cover, which would minimize the potential establishment of noxious weeds and non-native invasive plant species in the long term. The pit would not be reclaimed; however, due to the absence of soils and the formation of pit lakes, the potential for establishment of noxious weeds and non-native invasive plant species would be less likely.

3.15.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. As a result, the potential for the introduction or spread of noxious weeds and non-native invasive plant species would be less than the Proposed Action since 128 fewer acres would be disturbed.

3.15.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would be similar to the Proposed Action except that mining would be sequenced to allow backfilling portions of the open pit with waste rock during mining. The surface facilities and footprint for this alternative are identical to the Proposed Action, therefore the acres of disturbance and potential impacts from noxious weeds and non-native invasive plant species would be the same as described for the Proposed Action.

3.15.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and subsequent impacts associated with the introduction or spread of noxious weeds and non-native invasive plant species would not occur. Continuation of mining activities associated with the underground Storm Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations. Existing weed control measures would continue to be implemented to prevent the establishment of new populations and to control existing populations in mine-related disturbance areas.

3.15.3 Cumulative Impacts

The CESA for noxious weeds and non-native invasive plant species is described in Section 3.15.1, Affected Environment, and is shown in **Figure 3.15-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**, and their locations shown in **Figures 3.2-1** and **3.2-2**.

3.15.3.1 Proposed Action

Past, present, and RFFAs in the CESA have resulted, or would result, in approximately 36,455 acres of mine-related surface disturbance. Past, present, and RFFAs, from utility and energy development (North Elko Pipeline and TS Power Plant) have resulted, or would result, in up to 740 acres of additional disturbance. The proposed project would add 1,962 acres of new disturbance for a total cumulative disturbance of 39,157 acres. The proposed project represents approximately 5 percent of the total past, present, and RFFAs disturbance. Noxious weeds and non-native invasive plant species currently exist in the CESA. Surface disturbance activities from implementation of the proposed project as well as other future projects could further spread noxious weeds and non-native invasive plant species into previously undisturbed areas, and may increase the acreage and population numbers of already established noxious weeds and non-native invasive plant species populations. Other surface disturbing activities in the CESA that contribute to cumulative effects noxious weeds and non-native invasive plant species include livestock grazing, wildfire, all terrain vehicles, and recreation use. Cumulative impacts to noxious weeds and non-native invasive plant species within the CESA would be the same as described in the Leeville Project, Final Supplemental Environmental Impact Statement (BLM 2010b).

It is anticipated that the cumulative impacts to noxious weeds and non-native invasive plant species in the CESA from past, present, and RFFAs would result in the potential for the increased spread of noxious weeds and non-native invasive plant species into disturbed area created from surface disturbances associated with grazing, wildfires, and the development of mining projects and utility corridors. Linear surface disturbances such as utility corridors, roads, and trails provide corridors for further introduction and spread of noxious weeds and non-native invasive plant species (Gelbard and Belnap 2003; Watkins et al. 2003). These networks of corridors can then serve as a source of propagules (D'Antonio et al. 2001) for noxious weeds and non-native invasive plant species to spread into adjacent undisturbed areas.

It is assumed that the majority of the surface disturbance-related impacts within the CESA would be reclaimed, minimizing the introduction and/or spread of noxious weeds and non-native invasive plant species. Implementation of BDMV's Reclamation Plan and Noxious Weed Control Plan would minimize the introduction and/or spread of noxious weeds and non-native invasive plant species within the proposed project disturbance areas, thereby minimizing the project's contribution to cumulative effects.

3.15.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action, except that this alternative would add approximately 1,834 acres of new disturbance for a total cumulative disturbance of 39,029 acres. The single waste rock disposal facility alternative represents approximately 5 percent of the total past, present, and RFFAs disturbance.

3.15.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be similar to cumulative effects associated with the Proposed Action.

3.15.3.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and no additional cumulative effects from noxious weeds and non-native invasive plant species would occur.

3.15.4 Potential Monitoring and Mitigation Measures

No additional mitigation measures are recommended for noxious weeds and non-native invasive plant species.

3.15.5 Residual Impacts

Noxious weeds and non-native invasive plant species may persist over the long term regardless of the implementation of weed control programs.

3.16 Range Resources

3.16.1 Affected Environment

The study area for range resources includes the proposed Plan of Operations (PoO) boundary, the areas enclosed by the proposed fenceline, and the Bootstrap Haul Road, power connection yard, secondary access road entrance, and power transmission line corridor that occur outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) for range resources includes the grazing allotments (Boulder Field, Twenty Five, T Lazy S, and Marys Mountain) along the Carlin Trend (**Figure 3.16-1**).

Portions of two grazing allotments, Twenty Five and T Lazy S, occur in the study area. **Figure 3.16-1** illustrates these grazing allotments in relation to the study area. **Table 3.16-1** summarizes the active animal unit month (AUM) within the grazing allotments, acreage and projected AUM for each allotment within the study area, livestock type, season of use category, and percent of public land. The Twenty Five Allotment is the only grazing allotment within the proposed PoO boundary and is used for cattle and horses. The active cattle pasture is grazed year-round, while the active horse pastures are grazed in late winter and early spring. The Twenty Five Allotment consists of approximately 59 and 41 percent public and private land, respectively. Grazing management is determined for the Twenty Five Allotment, including individual pastures, on an annual basis in consultation with the Bureau of Land Management (BLM). The Bootstrap Haul Road crosses both the Twenty Five Allotment and a small portion of the T Lazy S Allotment. Livestock movement occurs in the study area during the fall and spring, especially in the vicinity of the Boulder Creek Road and Bootstrap Haul Road. The study area is located within and crossed by several BLM fences, which are part of the Boulder Seeding Fence. Water sources include intermittent and ephemeral streams, seeps, springs, and stock ponds. Range improvements in the study area include cattleguards, fences, and livestock ponds.

Table 3.16-1 Grazing Allotments in the Study Area and CESA

Grazing Allotment Name	Total Allotment Active AUMs[1,2]	Allotment Acreage within the CESA	Allotment Acreage within the Study Area	Livestock[1]	Season of Use[1]	Category	Percent of Public Land
Twenty Five	34,130	517,062	3,540	Cattle/ Horses	March 1 – February 28	Improve	59
T Lazy S	10,797	176,808	86	Cattle	February 15 – November 30	Improve	39
Boulder Field	838	11,888	N/A	Cattle	March 1 – May 31	Improve	51
Marys Mountain	1,408	34,951	N/A	Cattle	February 15 – October 31	Custodial	51

[1] The number and class of livestock, active AUMs, and stocking rates come from the full grazing permit numbers. Due to market conditions, rainfall, and amount of forage produced each year, actual numbers of livestock grazed and AUMs used are lower than the values above. Grazing permittees have the option to take non-use as conditions warrant.

[2] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

Source: BLM 2010c,f.

3.16.2 Environmental Consequences

Primary issues related to range resources include suspension of active AUMs due to direct loss of acreage caused by proposed disturbance or the potential for reduced forage production resulting from the loss of acreage and vegetation caused by the open pit mining operation; potential impacts to existing water sources and range improvements; and potential impacts to seasonal livestock movement within the Twenty Five Allotment.

3.16.2.1 Proposed Action

The potential impacts of the proposed project on range resources can be classified as short-term (temporary) and long-term duration. Short-term impacts result from surface disturbances, enclosures, and limited access to areas arising from construction, operation and interim and final reclamation activities. Short-term impacts would cease upon mine closure and completion of successful reclamation. Long-term impacts consist of permanent changes to forage availability and type, irrespective of reclamation success; permanent loss of range improvements, specifically water sources; and permanent changes in livestock management due to project related activities.

Under the proposed project, impacts to range resources would result from the installation of the perimeter fence around the proposed PoO boundary and surface disturbing activities associated with facilities located outside the proposed PoO boundary (i.e., Bootstrap Haul Road, electrical substation area, secondary access road entrance, and power transmission line corridor). The installation of the perimeter fence in combination with the current configuration of the Boulder Seeding Fence would exclude access to available forage inside the fenced areas. Outside the perimeter fence, surface disturbing activities would include the construction and operation of the associated ancillary facilities and the upgrade and widening of the Bootstrap Haul Road. **Table 3.16-2** lists the acreage of disturbance per allotment, number of AUMs per allotment, and the percentage of AUMs that could be lost from the installation of the perimeter fence around the proposed PoO boundary in combination with the current configuration of the Boulder Seeding Fence, and surface disturbing activities outside the perimeter fence. The proposed project would result in the exclusion of 3,333 acres of rangeland vegetation in the Twenty Five Allotment and 24 acres of rangeland vegetation in the T Lazy S Allotment from grazing. The proposed project would result in the reduction of approximately 687 AUMs in the Twenty Five Allotment. Taking into consideration the current configuration of the Boulder Seeding Fence in combination with the proposed project, an additional 585 AUMs (total of 1,272 AUMs) would be suspended during the life of the project. Long-term impacts would result in the loss of 472 acres and a reduction of 95 AUMs from the expansion of the open pit within the Twenty Five Allotment.

Table 3.16-2 Potential Impacts by Allotment

Grazing Allotment Name	Allotment Acreage Excluded from Grazing in Study Area	Projected Active AUMs Lost[1,2]	Percent Loss of Total Active AUMs
Twenty Five	3,333	687/1,272 [3,4]	2/4[3]
T Lazy S	24	<1	<1
Total	**3,357**	**687/1,272[3]**	--

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

[2] Projected active AUMs lost and percent active AUM loss for Twenty Five Grazing Allotment were provided by BLM. For T Lazy S the project active AUMs lost and percent active AUM loss were calculated based on an average stocking rate within the surface disturbance-related impact area.

[3] AUMs suspended based on the proposed project only/AUMs suspended based on the proposed project in combination with current configuration of the Boulder Seeding Fence.

[4] Approximately 95 AUMs would represent a long-term loss from the expansion of the open pit, which would not be reclaimed.

Source: BLM 2010c,f.

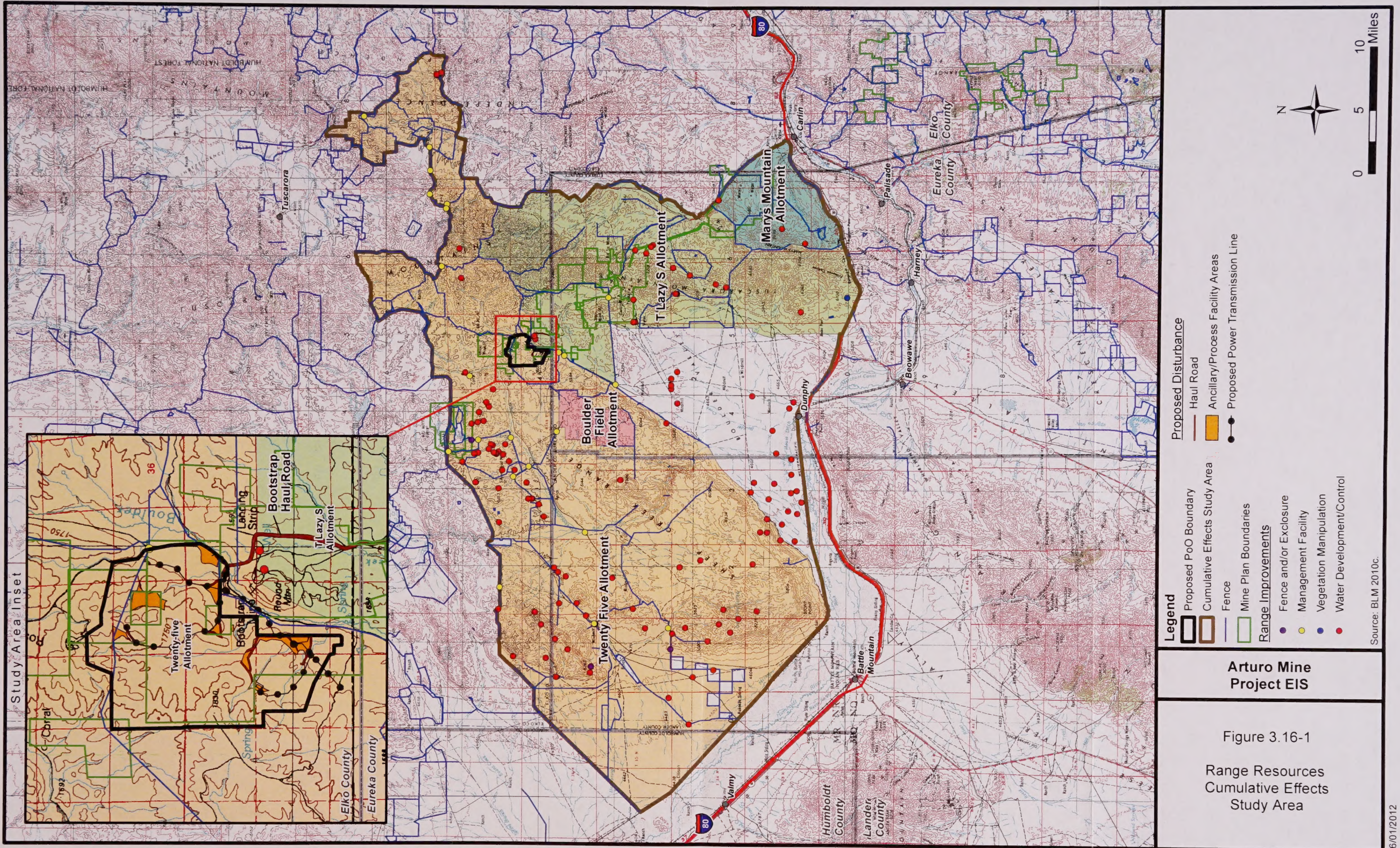


Figure 3.16-1

Range Resources Cumulative Effects Study Area

Source: BLM 2010c.

06/01/2012

Direct effects to range resources would result from surface disturbing activities, increased vehicle traffic, potential damage to range improvements (e.g., fences, gates, and water sources), limited access to water sources, and expanded road and utility networks. The proposed project would result in the short-term loss of forage during facility construction, operation, and reclamation of the proposed project; and a long-term loss of forage from the expansion of the open pit that would not be reclaimed. The installation of the perimeter fence would result in the loss of forage, restrict cattle movement, and limit access to water sources. An increase in traffic, especially along the Bootstrap Haul Road, could lead to increased mortality and injuries to livestock, and cause disruptions to livestock management. Vehicle traffic along the Bootstrap Haul Road would disrupt livestock management during seasonal cattle movements between summer and winter grazing areas.

Indirect impacts would include the spread of noxious weeds and non-native invasive plant species, and fugitive dust that could result in a reduction of forage and forage quality. Following surface disturbance activities, noxious weeds and non-native invasive plant species may readily spread and colonize areas that typically lack or have minimal vegetative cover or areas that have been recently disturbed. Impacts from increased erosion and invasion and spread of noxious weeds and non-native invasive plant species could cause the potential conversion of native vegetative communities resulting in a loss of forage. The conversion of native vegetative communities and associated loss of forage could potentially be a permanent change resulting in a long-term impact. Water quality in ponds and reservoirs could be impacted as a result of erosion from construction activities.

Impacts to grazing allotments would be minimized through the implementation of the Barrick Dee Mining Venture (BDMV) applicant-committed environmental protection measures developed in consultation with the grazing allotment permittee and the BLM. BDMV has committed to several applicant-committed environmental measures specifically addressing the grazing allotment lease holder's concerns regarding cattle movement and access to water during construction and operation of the proposed project (Section 2.3.9, Applicant-committed Environmental Protection Measures). BDMV would establish cattleguards and associated fencing to prevent cattle movement into proposed project areas as shown in **Figure 2-2**). To facilitate cattle movement during seasonal cattle drives, BDMV would coordinate with the Twenty Five Allotment permittee and the BLM to identify measures to facilitate cattle movement during the seasonal cattle drives.

To address concerns about access to water sources during the spring and fall cattle drives for the life of the proposed project, BDMV has committed to providing additional sources of water by developing two new water supply wells, by trucking water to a tank, or by providing water via a water pipeline from the proposed Arturo project facilities area (Section 2.3.9.10, Cattle Movement and Access to Water). The remaining applicant-committed environmental protection measures, would minimize soil erosion, and the potential for the establishment of noxious weeds and non-native invasive plant species through erosion controls, and concurrent and post-reclamation. Satisfactory revegetation of mine-related disturbance areas (i.e., assuming the primary goal of soil stabilization through presence of adequate plant cover) is anticipated to occur approximately 3 to 15 years following reclamation. After 25 years, the reclaimed plant communities likely would consist of adequate herbaceous plant cover with sufficient diversity to substantially reduce the potential for soil erosion and provide forage for use by livestock.

Two range improvements are located within the vicinity of the study area: a cattleguard to restrict pronghorn access and a water well that is not currently flowing. It is anticipated that these range improvements would not be impacted by the proposed project.

3.16.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of disturbance. Both the West and East WRDFs would be located within the same proposed perimeter fence of the proposed PoO boundary. Therefore, the acres of disturbance and potential impacts to range resources would be the same as described for the Proposed Action.

3.16.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would be similar to the Proposed Action except that mining would be sequenced to allow backfilling portions of the open pit with waste rock during mining. The surface facilities and footprint for this alternative are identical to the Proposed Action, therefore, the acres of disturbance and potential impacts to range resources would be the same as described for the Proposed Action.

3.16.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to range resources would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, ongoing mineral exploration activities, and reclamation within the study area, would be conducted under existing authorizations.

3.16.3 Cumulative Impacts

The CESA for range resources is defined in Section 3.16.1, Affected Environment, and is shown in **Figure 3.16-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; and their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.16.3.1 Proposed Action

Four grazing allotments (Twenty Five, T Lazy S, Marys Mountain, and Boulder Field) are located within the grazing allotment CESA. **Table 3.16-1** summarizes the grazing allotment total active AUMs, allotment acreage, livestock type, season of use, and category for each grazing allotment within the CESA. The majority of the permitted use is for cattle grazing.

Past, present, and RFFAs in the CESA have resulted, or would result, in approximately 36,455 acres of mine-related surface disturbance. Past, present, and RFFAs from utility and energy development (North Elko Pipeline) would result in up to 140 acres of additional disturbance. The proposed project incrementally would add 3,357 acres to the disturbance for a total of 39,952 acres, an 8 percent increase over the total of past, present, and RFFAs disturbance. The acres of disturbance for the proposed project for range resources includes the surface disturbance associated with the proposed project and the expansion of the perimeter fence outside the proposed PoO boundary. It is assumed that portions of past mine-related disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue to reduce the impacts to range resources.

Past, present, and RFFAs within the CESA have resulted, or would result, in the loss of approximately 36,595 acres from mining and utility and energy development, resulting in the exclusion of approximately 2,176 AUMs from active grazing preference. The proposed project incrementally would reduce the active grazing preference by an additional 3,357 acres (687 AUMs) resulting in a total cumulative disturbance of approximately 39,952 acres (2,863 AUMs - approximately 6 percent of AUMs within the CESA). Other surface disturbing activities in the CESA that contribute to cumulative effects for range resources include introduction and spread of noxious weeds and non-native invasive plant species and wildfire. Past, present, and RFFAs would cumulatively and incrementally reduce available acres from active grazing preference during construction and operation activities. Cumulative impacts to range resources within the CESA are discussed specifically in the Leeville Project, Final Supplemental EIS (BLM 2010b).

Much of the area encompassed by the CESA have been affected by wildfire (**Figure 3.2-3**). Some areas had adequate native perennial grasses and did not require herbaceous reseeding following wildfires. Other restoration projects have included fencing burned areas to allow vegetation to recover.

Additional disturbance associated with reasonably foreseeable mining and exploration project disturbance would have minimal affect on grazing allotments as most development would occur within existing permitted boundaries where adjustments to grazing use have previously occurred. Reclamation of mine-related disturbances in the CESA would be incremental as various operations reach the end of active mining and begin closure activities. In many of the mines, permanent disturbance would be associated with the open pits that would not be reclaimed; some would be partially filled with water. Following reclamation, the majority of mine sites would be made available for grazing.

Successful reclamation and revegetation of these areas would result in an increase in herbaceous vegetation that would then be available for forage. Following reclamation, these sites are often more productive than adjacent native sites as native cultivars are used for reclamation and competition is limited to only those few species in the seed mixture.

3.16.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action.

3.16.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative would be similar to cumulative effects associated with the Proposed Action.

3.16.3.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and no additional cumulative effects to range resources would occur.

3.16.4 Potential Monitoring and Mitigation Measures

The following mitigation measures are recommended for range resources.

Issue: Development of the proposed project would reduce available land for grazing for the life of the project.

Mitigation Measure R-1: In order to offset project-related impacts to grazing, BDMV would repair five pit reservoirs at the Water Canyon spring complex area by dredging sediment from the existing pit reservoirs and installing liners at the bottom of the reservoirs to retain water runoff from nearby springs.

Effectiveness: Implementation of this mitigation measure would offset project-related impacts to grazing by improving an existing source of surface water for livestock within the project region.

Issue: The installation of the project fence in combination with the Boulder Seeding Fence would result in an additional 585 AUMs being suspended from livestock grazing.

Mitigation Measure R-2: Implement modifications to the Boulder Seeding Fence as shown in **Figure 3.16-2** that would remove portions of the fence, and add portions of fence to limit AUMs being suspended to only those affected by the installation of the proposed project fence.

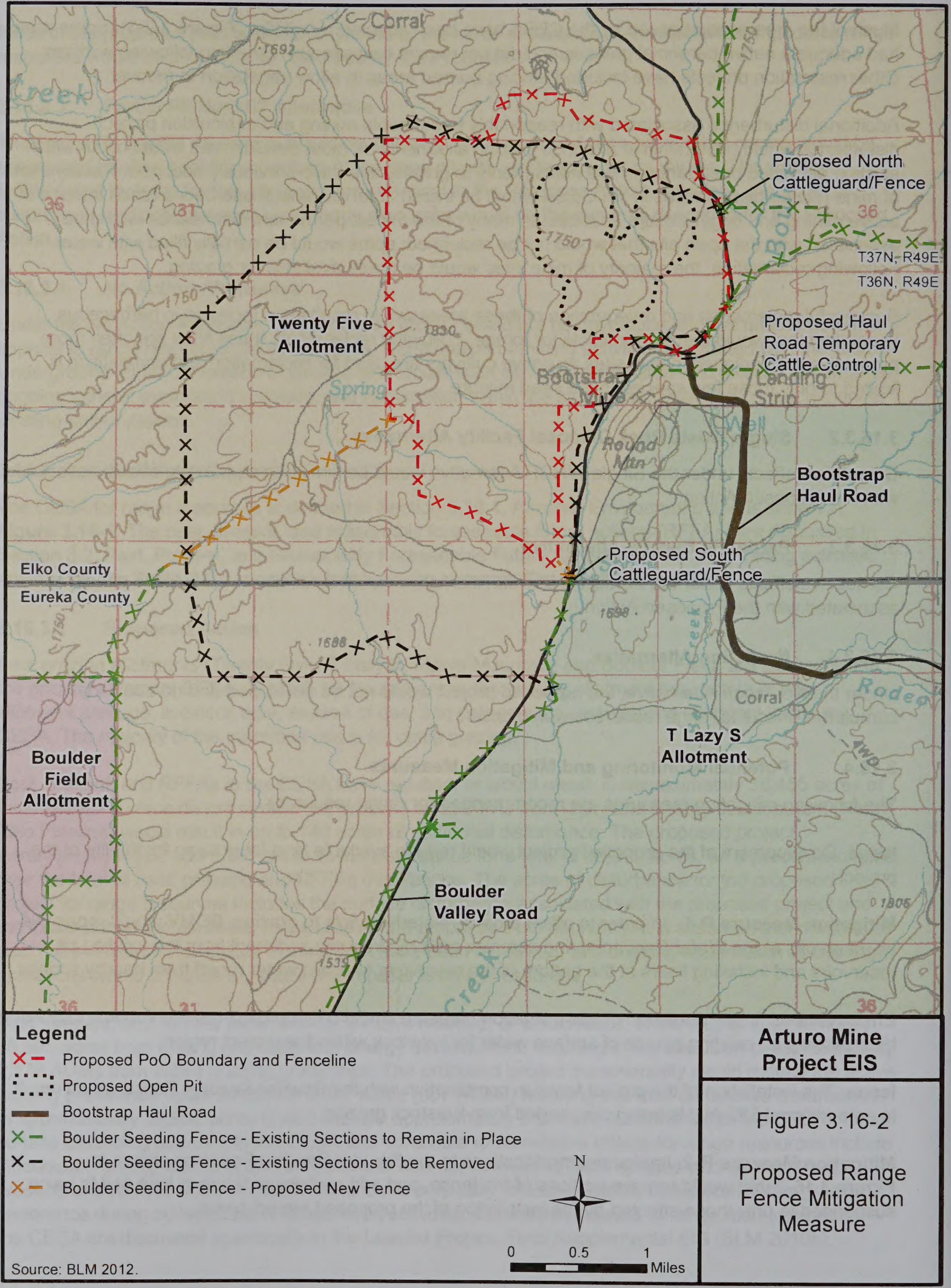


Figure 3.16-2

Proposed Range Fence Mitigation Measure

05/24/2012

Effectiveness: Mitigation Measure R-2 would adjust the Boulder Seeding Fence to limit the suspension of AUMs to only those within the proposed project fence.

Issue: Unidentified range improvements may be found within the study area during construction and operation activities.

Mitigation Measure R-3: If an unidentified range improvement is found to be within the construction footprint, impacts to the range improvement would be minimized through avoidance or by moving of the range improvement to an alternate location. If livestock water sources cannot be avoided, they would be moved a minimum of 200 feet away from construction and operation activities.

Effectiveness: Mitigation Measure R-3 would provide location information about range improvements and provide further mitigation measures if an unidentified range improvement is found. The mitigation measure would minimize impacts to unidentified water-related range improvements.

Issue: Fences could be damaged or destroyed during construction and operation activities.

Mitigation Measure R-4: Any fences damaged or destroyed during construction and operation would be repaired.

Effectiveness: Mitigation Measure R-4 would repair fences damaged or destroyed during construction and operation activities.

3.16.5 Residual Impacts

Residual impacts to range resources would include the permanent loss of 95 AUMs from the loss of forage in areas associated with the expansion of the open pit, which would not be reclaimed.

3.17 Wildlife and Aquatic Biological Resources

3.17.1 Affected Environment

The study area for wildlife and aquatic resources includes the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor that occur outside of the proposed PoO boundary; and riparian, stream, spring/pond, and wetland habitats along Boulder Creek; and the haul road crossing at Bell Creek.

The Cumulative Effects Study Areas (CESAs) for wildlife resources generally extend from the northern end of the Independence Range northeast of the study area, south to the Humboldt River and the northern end of the Piñon Range. The wildlife CESAs were determined based on wildlife use within the project region and important seasonal habitats for species such as mule deer, pronghorn, and elk (**Figures 3.17-1** through **3.17-4**). The CESA for aquatic resources encompasses the Boulder Creek drainage located within the mine boundary, as well as downgradient sections of Boulder Creek through Boulder Flat (**Figure 3.17-5**). The rationale for selecting this CESA for aquatic biological resources was based on the impact conclusion of negligible impacts on surface water resources beyond the Boulder Creek watershed (Section 3.4, Water Resources and Geochemistry).

3.17.1.1 Wildlife Resources

As discussed in Section 3.14, Vegetation including Riparian Zones and Wetland Areas, three vegetation cover types and one land use cover type are located within the study area. The vegetation cover types include sagebrush shrubland, grassland, and herbaceous wetland habitats. The land use cover type found within the study area is primarily disturbed lands (i.e., mining disturbance). Sagebrush shrubland is the most common vegetation community within the study area. The majority of the proposed project consists of previously disturbed and reclaimed areas.

Wildlife species and habitats found within the study area are typical of the Great Basin region (Rawlings and Neel 1989). Available water for wildlife consumption is limited in the study area. Water sources, particularly those that maintain open water and riparian vegetation, support a greater diversity and population density of wildlife species than any other habitat types occurring in the study area (Rawlings and Neel 1989). Herbaceous wetland habitat occurs at six small sites within the proposed study area (Cedar Creek Associates, Inc. [Cedar Creek] 2009). In addition, herbaceous wetland habitat occurs along portions of Boulder Creek, which originates northwest of the study area in the Tuscarora Mountains. Boulder Creek is classified as intermittent through the study area (JBR 2012).

Information regarding wildlife species and habitat within the study area and CESAs was obtained from a review of existing published sources, site-specific surveys, Bureau of Land Management (BLM), Nevada Department of Wildlife (NDOW), and United States Fish and Wildlife Service (USFWS) file information, as well as Nevada Natural Heritage Program (NNHP) database information.

3.17.1.2 Big Game Species

Mule deer, pronghorn, and elk are the primary big game species within the project region (Miller 2010; NDOW 2010b,c). The study area occurs entirely within NDOW's Management Area 6, specifically hunting unit 068.

Population numbers for mule deer, pronghorn, and elk fluctuate slightly from year-to-year based on habitat conditions. Water availability and amount of quality habitat are the limiting factors within the study area. Water availability, forage quality, cover, and weather patterns typically determine the level of use and movement of big game species through the study area. Winter use in the vicinity of the study area depends on weather and forage availability.

Mule Deer

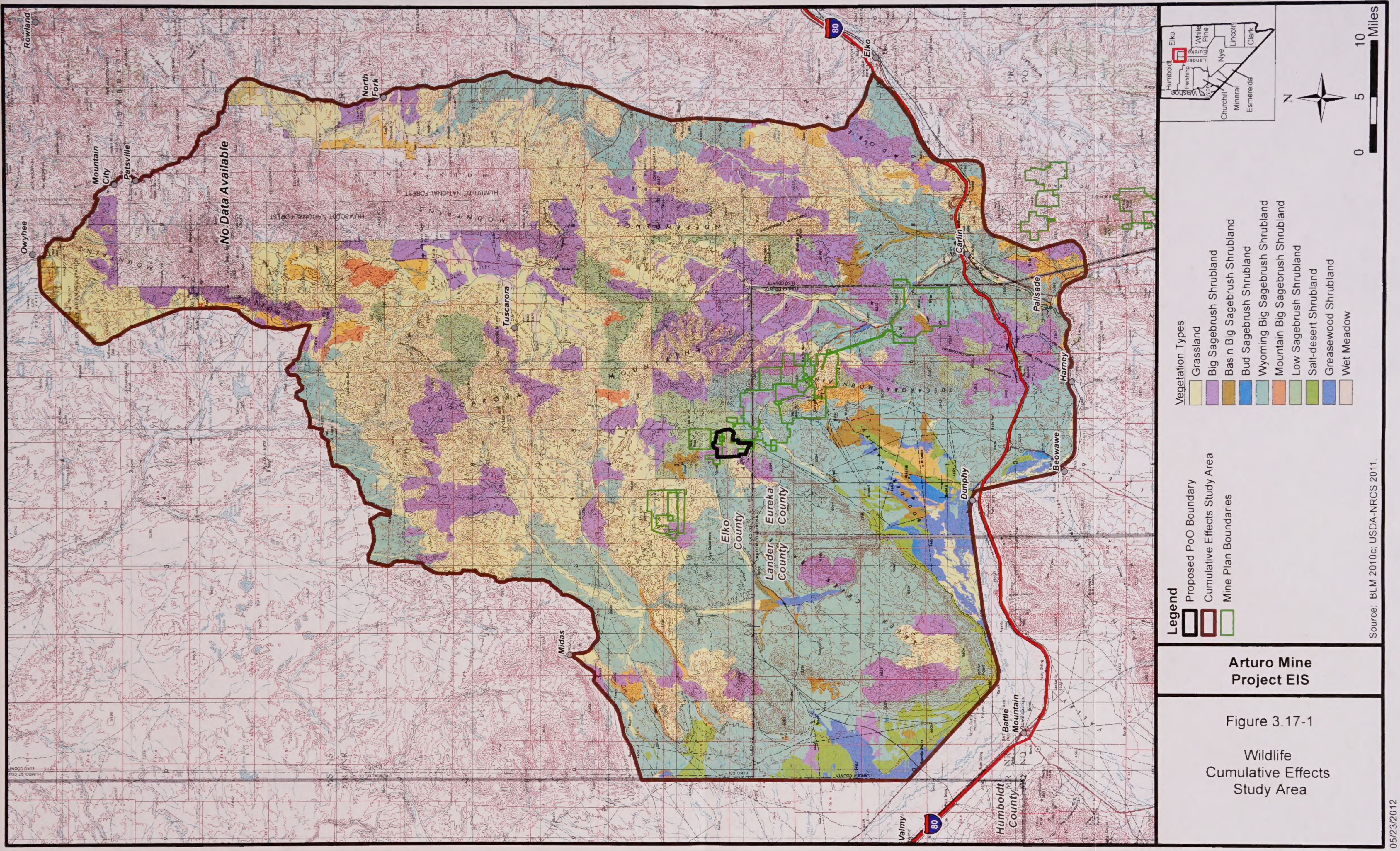
Population numbers for mule deer in Management Area 6 have shown a general decline over the last 10 years due to a reduction in winter habitat quality, primarily resulting from wildfires (**Figures 3.2-3** and **3.13-3**). Large scale fires from 1999 to 2007 have caused a severe reduction in available forage (i.e., shrub browse) and an overall increase of noxious weeds and invasive plant species such as thistle, white-top, and cheatgrass (BLM 2008b; NDOW 2010c). However, improved habitat conditions from increased precipitation in 2009 have resulted in a 12 percent increase in mule deer populations in 2010. During spring 2011 helicopter surveys, NDOW classified approximately 3,810 mule deer in Management Area 6 (NDOW 2011).

Mule deer use of the study area is highly variable but typically peaks during fall and spring migrations. The majority of the mule deer in the project region typically spend the summer months in the Tuscarora Mountains, north of the study area, and winter in Boulder Creek and the Dunphy Hills area, south of the study area (Area 6 Mule Deer Working Group 2010). The study area consists mainly of mule deer limited use habitat, which may be used by mule deer throughout the year depending on forage conditions. Approximately 1,344 acres of undisturbed (e.g., not burned) limited use habitat occurs within the study area. Due to the geographic location of the study area between mule deer summer and winter range, the study area also has been designated as an important mule deer migration corridor by the NDOW (**Figure 3.17-6**). This migration corridor is primarily used by mule deer; however, pronghorn also use the study area, including the migration corridor, depending on weather patterns and snow conditions. Details on the big game migration corridor are presented below.

The proposed project and other mining operations within the Carlin Trend are located in the vicinity of migration corridors that connect important summer and winter range for big game (mule deer, pronghorn, and elk). Over the past 10 to 20 years, seasonal big game movement corridors have been restricted due to mining operations in the project region (BLM 2010a,b, 2008b). By definition, a wildlife movement corridor is a linear habitat with a primary function of connecting at least two significant habitat areas (Sawyer et al. 2005). Throughout the western United States, big game species rely on seasonal ranges to satisfy their annual nutritional and energetic requirements (Sawyer et al. 2005).

In this region of Nevada, a large herd of mule deer migrates south from its summer range in the Tuscarora Mountains, Independence Range, and Bull Run Mountains to its winter range in the lower elevations of Boulder Valley and the Dunphy Hills (BLM 2010a,b, 2008b; NDOW 2010c). Little Boulder Valley and surrounding areas developed by mining operations (**Table 3.17-1**) were part of a historic mule deer migration corridor for movement to and from the winter range in the Dunphy Hills. In addition, mule deer also move through the Arturo/Rossi Mine area west to the Santa Renia Mountains. Historically, up to 4,000 deer migrated through these areas twice annually. From the 1960s to the 1980s, the vegetation in this part of the Carlin Trend was converted to cheatgrass following wildfires. Due to the expansion of mining developments along the east side of the Tuscarora Range, little opportunity remains for unimpeded north/south big game movement (BLM 2008b; NDOW 2010c).

However, the Carlin Trend is known for mining. As the mines continue to expand, the landscape would continue to change, which may create more impediments for mule deer migration and completely block the migration corridor in the future. The mines continue to conduct concurrent reclamation when possible. Mine reclamation in the area has converted areas vegetated with cheatgrass and crested wheatgrass into areas vegetated with native shrubs, grasses and forbs, which improves wildlife habitat. Some mule deer have moved to the eastern side of the mountain range for migration and cross through the area around the Carlin Mine.



Source: BLM 2010c; USDA-NRCS 2011.

Arturo Mine Project EIS

Figure 3.17-1

Wildlife Cumulative Effects Study Area

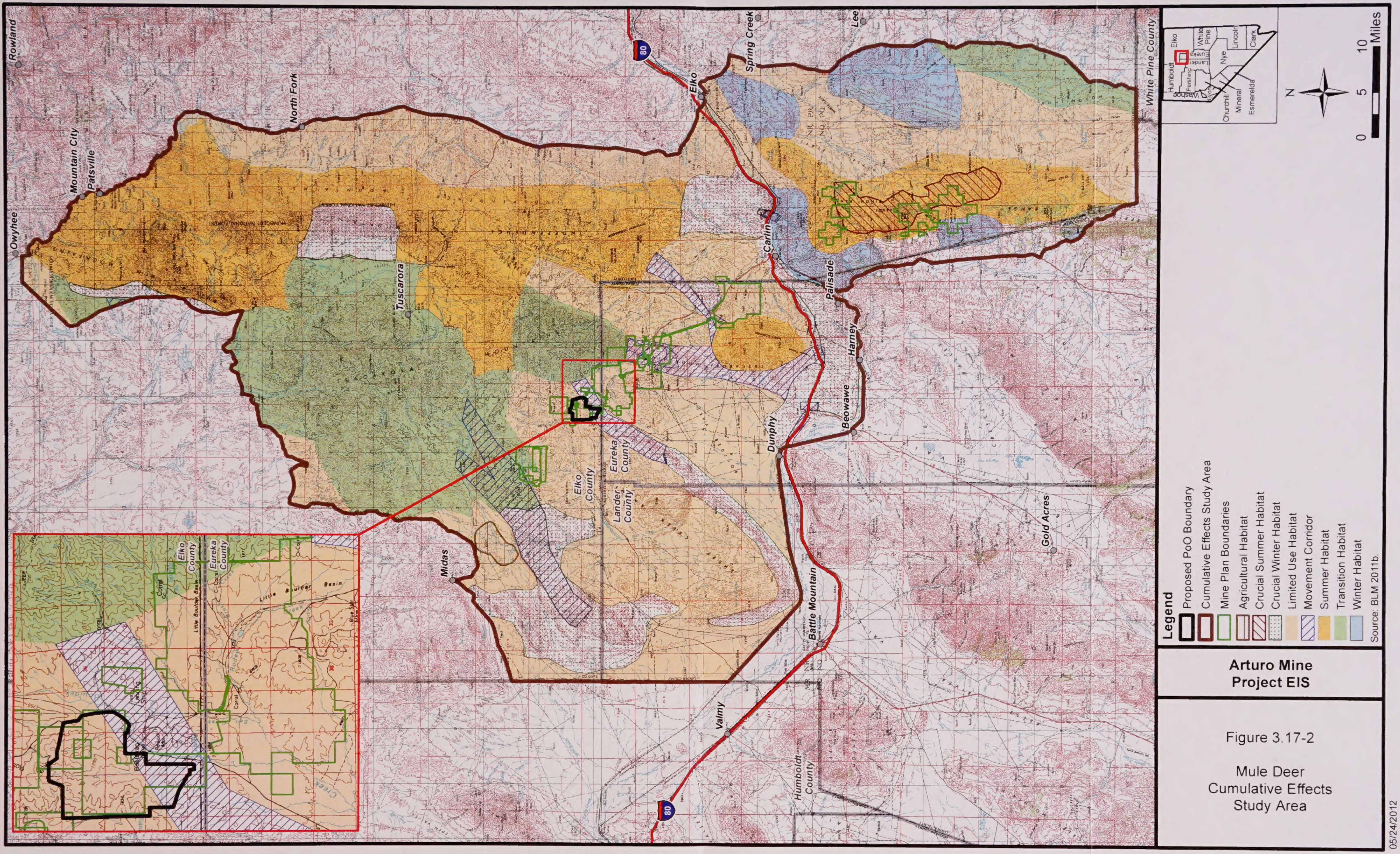
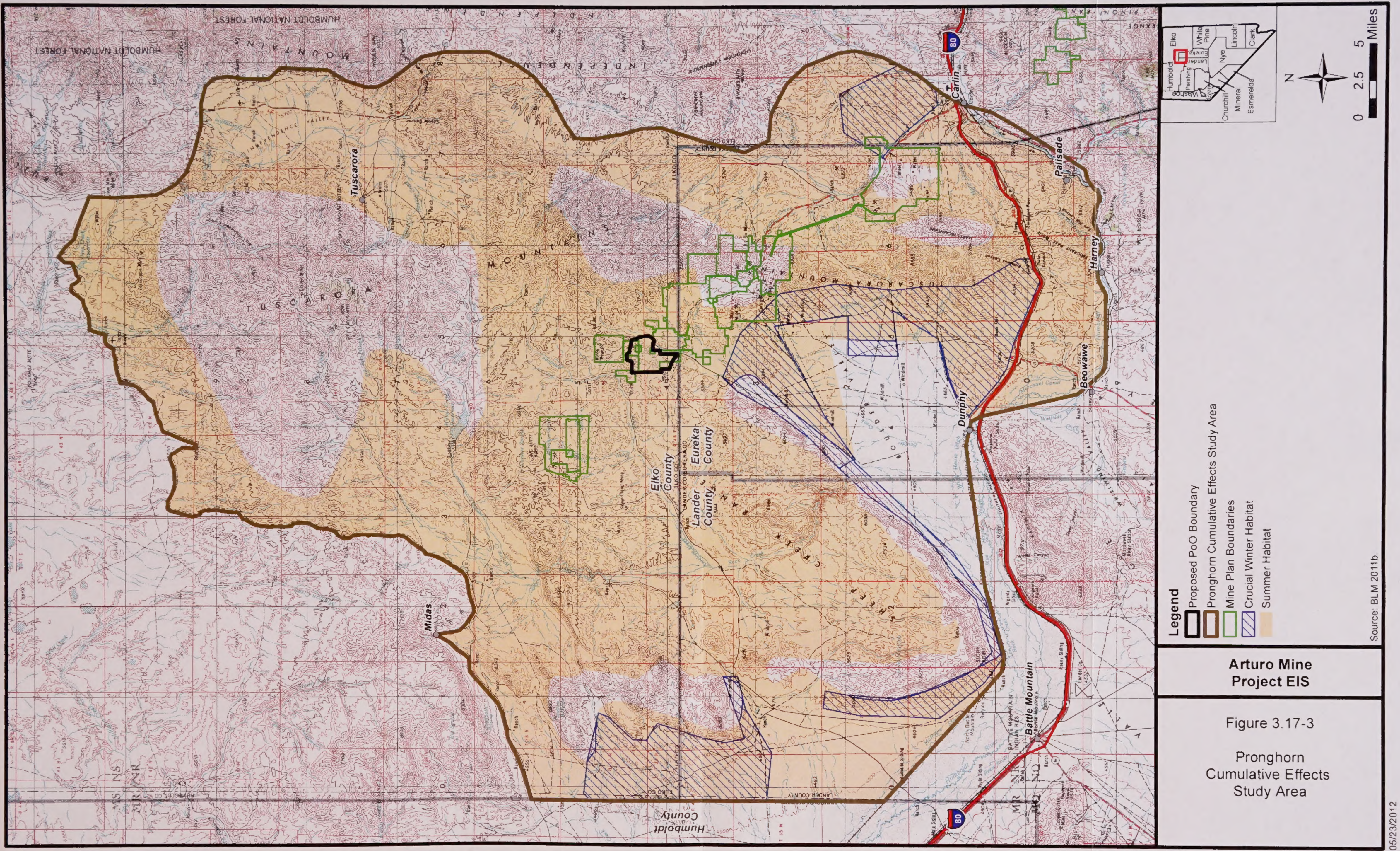


Figure 3.17-2

Mule Deer Cumulative Effects Study Area



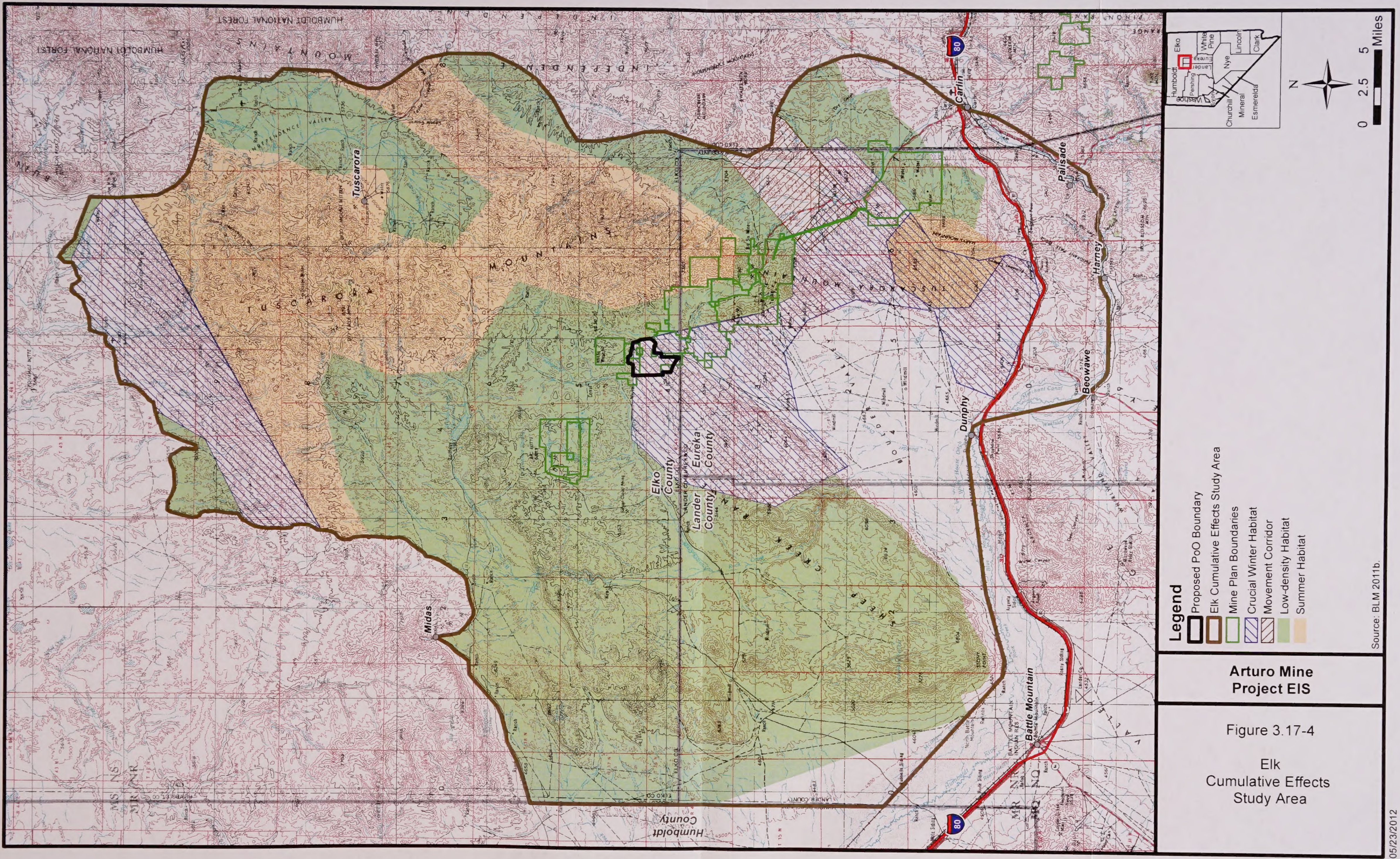
Source: BLM 2011b.

05/23/2012

Arturo Mine Project EIS

Figure 3.17-3

Pronghorn Cumulative Effects Study Area

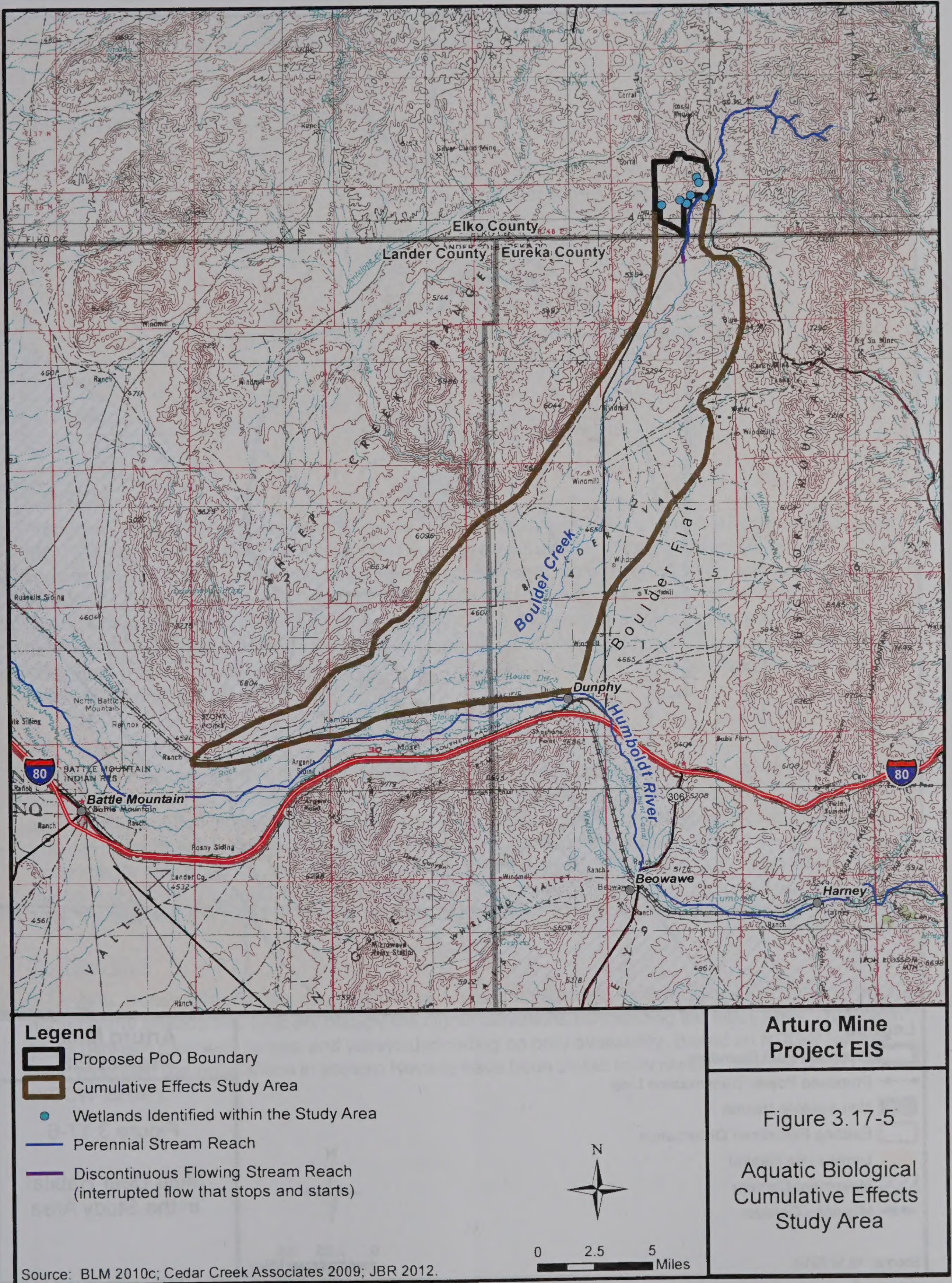


Source: BLM 2011b.

Arturo Mine Project EIS

Figure 3.17-4

Elk Cumulative Effects Study Area



Source: BLM 2010c; Cedar Creek Associates 2009; JBR 2012.

Arturo Mine Project EIS

Figure 3.17-5

Aquatic Biological Cumulative Effects Study Area

05/20/2012

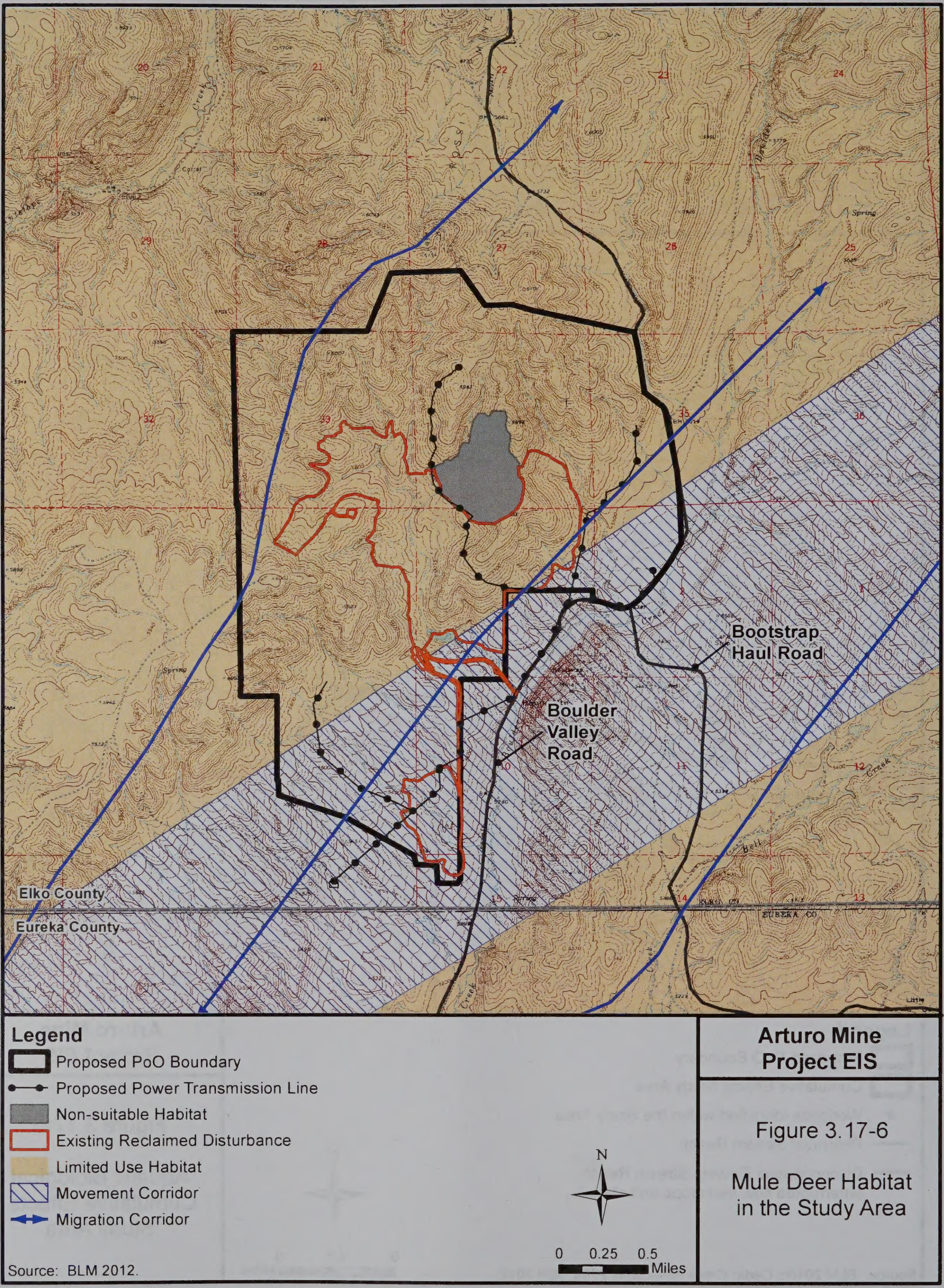


Figure 3.17-6

Mule Deer Habitat in the Study Area

Source: BLM 2012.

05/24/2012

Table 3.17-1 Mines Impacting the Mule Deer Migration Corridor

Mining Company	Mine
Barrick Goldstrike Mines Inc. (BGMI)	Goldstrike Mine (Betze Project)
	Ren Mine
Newmont	Genesis/ Blue Star Mine
	Lantern Mine
	Carlin Mine
	Bootstrap/Capstone Mine
	Tara Mine
Halliburton	Rossi Mine
Marigold	Dee Mine

Pronghorn

Pronghorn numbers have been stable to increasing in Management Area 6 over the past several years (BLM 2008b; NDOW 2010c). NDOW ground surveys classified 766 animals during January 2011 surveys (NDOW 2011). Use of the study area by pronghorn is highly dependent on water and forage availability. However, successful reclamation efforts within the proposed project have resulted in an increase in grasses and forbs favored by pronghorn. The entire study area is designated as summer habitat. Approximately 1,809 acres of undisturbed (e.g., not burned) summer habitat occurs within the study area (**Figure 3.17-7**). Crucial winter habitat occurs south of the study area along the north edge of Boulder Valley (**Figure 3.17-3**).

Elk

Elk numbers in Management Area 6 have increased over the last several years due to an increase in herbaceous forage as a result of wildfires (NDOW 2011). NDOW currently estimates the herd at approximately 550 animals (Miller 2010; NDOW 2011). Although elk are not typically found within the study area, small herds may occupy the area depending on weather and forage conditions. NDOW has designated a majority of the study area as crucial winter habitat with a small portion designated as low-density habitat (**Figure 3.17-8**). Approximately 1,645 acres of undisturbed (e.g., not burned) crucial winter habitat and 164 acres of undisturbed low-density habitat occur within the study area.

Mountain Lion

In Nevada, mountain lions also are classified as a big game species. Mountain lions are fairly common in north-central Nevada and typically occupy the higher elevations surrounding the study area. They often travel between mountain ranges and valleys depending on prey availability. Based on NDOW harvest data, mountain lion populations in eastern Nevada have been stable to increasing over the past 5 years (NDOW 2010c).

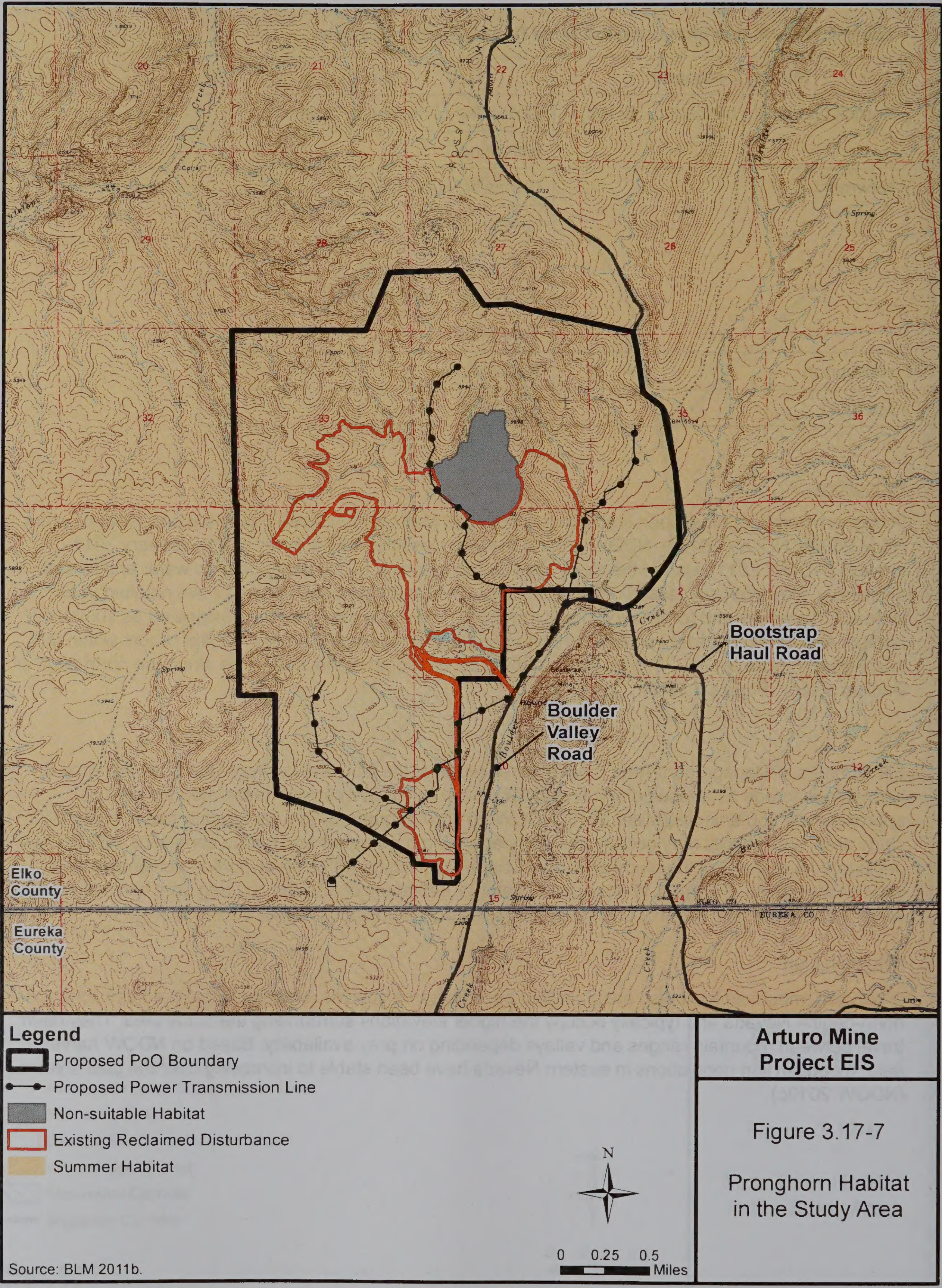
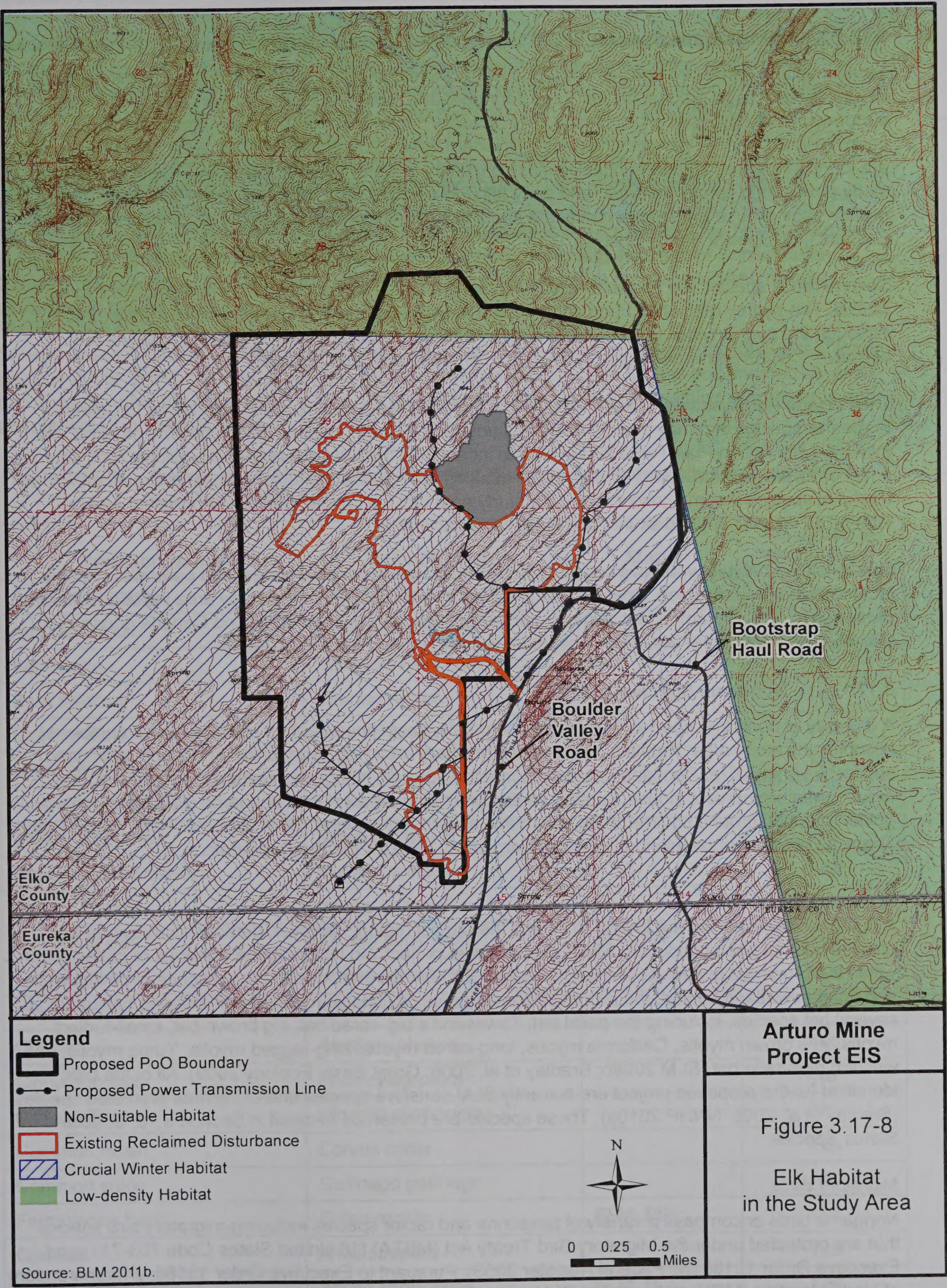


Figure 3.17-7

Pronghorn Habitat in the Study Area

Source: BLM 2011b.

05/24/2012



Arturo Mine Project EIS

Figure 3.17-8

Elk Habitat in the Study Area

Source: BLM 2011b.

05/24/2012

3.17.1.3 Small Game Species

Several upland game bird species are found within the study area. Species that occur within the area include greater sage-grouse, chukar, gray partridge, and mourning dove. Chukar occur in the hills surrounding the proposed project, especially on rocky ridges and hillsides with cheatgrass. Gray partridge are found in riparian zones along Boulder Creek (BLM 2008b; NDOW 2009). Mourning doves are found in a wide range of habitats in close proximity to water and are most likely to occur within the study area during spring, summer, and early fall (Floyd et al. 2007; Wildlife Action Plan Team 2006). The greater sage-grouse is a federal candidate and a BLM sensitive species and is discussed in detail in Section 3.18, Special Status Species.

Several rabbit species are known to occur within the study area, including the cottontail and pygmy rabbits. The pygmy rabbit has been documented at two locations in the project vicinity (Miller 2009). Although the pygmy rabbit is considered a game species in Nevada (NDOW 2009), it also is a BLM sensitive species and is discussed in Section 3.18, Special Status Species.

The Nevada Administrative Code (NAC) 503.025 classifies several mammal species as furbearers. Furbearer species that may occur within the study area include gray fox, kit fox, bobcat, muskrat, and mink (Wildlife Action Plan Team 2006). Due to increased structural diversity and available food sources, a higher diversity of furbearers is likely present along the riparian zone along Boulder Creek. Other mammal species that may occur within the study area include coyote, badger, short-tailed weasel, long-tailed weasel, spotted skunk, and black-tailed jackrabbit.

Due to limited habitat, waterfowl concentrations are limited to ponds, springs, and perennial streams located in the project region. Species that are likely to be found within the study area include mallard, blue-winged teal, cinnamon teal, wigeon, gadwall, pintail, ring-necked duck, and Canada goose (Floyd et al. 2007; Great Basin Ecology 2009; Wildlife Action Plan Team 2006).

3.17.1.4 Nongame Species

A diversity of nongame species (e.g., small mammals, passerines, raptors, reptiles, and amphibians) occupies the study area. Habitats found within the study area (e.g., sagebrush shrubland, grassland) support a variety of resident and seasonal nongame species. Nongame mammals include the deer mouse, western harvest mouse, vagrant shrew, Merriam's shrew, Ord's kangaroo rat, sagebrush vole, golden-mantled ground squirrel, least chipmunk, and desert woodrat (BLM 2008b; Wildlife Action Plan Team 2006). Rodent populations provide a large prey base for the area's predators.

Bats

A number of bat species are known to inhabit the project region; however, detection surveys for bat species has not been conducted within the proposed project. No historic mine workings or caves occur within the proposed project (Great Basin Ecology 2009). However, due to the presence of pit highwalls and riparian/wetland habitat, the proposed project contains suitable roosting and foraging habitat for several bat species, including the pallid bat, Townsend's big-eared bat, big brown bat, small-footed myotis, little brown myotis, California myotis, long-eared myotis, long-legged myotis, Yuma myotis, and western pipistrelle bat (BLM 2008b; Bradley et al. 2006; Great Basin Ecology 2009). All of the bats identified for the proposed project are currently BLM sensitive species and/or Nevada protected species (Bradley et al. 2006; NNHP 2010a). These species are presented in detail in Section 3.18, Special Status Species.

Migratory Birds

Nongame birds encompass a variety of passerine and raptor species including migratory bird species that are protected under the Migratory Bird Treaty Act (MBTA) (16 United States Code 703-711) and Executive Order 13186 (66 Federal Register 3853). Pursuant to Executive Order 13186, a Memorandum of Understanding (MOU) between the BLM and USFWS outlines a collaborative approach to promote the conservation of migratory bird populations. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds in coordination with state, tribal, and local governments. This MOU identifies specific activities where cooperation between the BLM and USFWS would contribute to the conservation of migratory birds and their habitat. In addition, the BLM Nevada State Office prepared Migratory Bird Best Management Practices (BMPs) for the Sagebrush Biome in order to assist BLM field offices in the consideration of migratory birds in land management activities (BLM 2003b). In Nevada, all birds protected under the MBTA also are state protected (NAC 503.050). Many of the sensitive migratory bird species found in Nevada also are identified in the Nevada Partners in Flight (PIF) Bird Conservation Plan (Neel 1999). This plan, along with the Birds of Conservation Concern (BCC) Plan (USFWS 2008b), prioritizes migratory bird species for management actions according to habitat types.

Several baseline biological surveys have been conducted within the study area since 2008 (Great Basin Ecology 2009; SRK Consulting (U.S.) Inc. [SRK] 2009b). In addition, NDOW has documented several bird species within the study area. In total, 29 avian species have been found within the study area and are presented in **Table 3.17-2**.

Table 3.17-2 Inventory of Migratory and Resident Bird Species Potentially Occurring within the Study Area

Common Name	Scientific Name	Status[1]	Observed in Study Area[2]
American kestrel	*Falco sparverius*		No
American robin	*Turdus migratorius*		Yes
Bald eagle	*Haliaeetus leucocephalus*	BCC	No
Barn swallow	*Hirundo rustica*		Yes
Barn swallow	*Hirundo rustica*		Yes
Black-billed magpie	*Pica pica*		No
Brewer's blackbird	*Euphagus cyanocephalus*		No
Brewer's sparrow	*Spizella breweri*	BCC	Yes
Brown-headed cowbird	*Molothrus ater*		Yes
Bullock's oriole	*Icterus bullockii*		No
Burrowing owl	*Athene cunicularia*	BLM, PIF	Yes
Canada goose	*Branta canadensis*		Yes
Chipping sparrow	*Spizella passerina*		Yes
Chukar	*Alectoris chukar*		Yes
Cinnamon teal	*Anas cyanoptera*		No
Cliff swallow	*Hirundo pyrrhonota*		No
Common raven	*Corvus corax*		Yes
Common snipe	*Gallinago gallinago*		No
Ferruginous hawk	*Buteo regalis*	BLM, PIF	Yes
Gadwall	*Anas strepera*		Yes
Golden eagle	*Aquila chrysaetos*	BLM, BCC	Yes

Table 3.17-2 Inventory of Migratory and Resident Bird Species Potentially Occurring within the Study Area

Common Name	Scientific Name	Status[1]	Observed in Study Area[2]
Gray partridge	*Perdix perdix*		No
Greater sage-grouse	*Centrocercus urophasianus*	BLM, BCC, PIF	Yes
Horned lark	*Eremophila alpestris*		Yes
Juniper titmouse	*Baeolophus ridgwayi*	BLM, PIF	No
Killdeer	*Charadrius vociferus*		Yes
Lark sparrow	*Chondestes grammacus*		No
Lewis's woodpecker	*Melanerpes lewis*	BLM, BCC, PIF	No
Loggerhead shrike	*Lanius ludovicianus*	BLM, BCC, PIF	No
Long-billed curlew	*Numenius americanus*	BCC, PIF	Yes
Mallard	*Anas platyrhynchos*		Yes
Mourning dove	*Zenaida macroura*		Yes
Northern flicker	*Colaptes auratus*		No
Northern rough-winged swallow	*Stelgidopteryx serripennis*		Yes
Pinyon jay	*Gymnorhinus cyanocephalus*	BLM, BCC, PIF	No
Prairie falcon	*Falco mexicanus*	BLM, PIF	Yes
Red-tailed hawk	*Buteo jamaicensis*		Yes
Red-winged blackbird	*Agelaius phoeniceus*		Yes
Ring-necked duck	*Aythya collaris*		Yes
Rough-legged hawk	*Buteo lagopus*		No
Sage sparrow	*Amphispiza belli*	BCC, PIF	Yes
Sage thrasher	*Oreoscoptes montanus*	BCC, PIF	Yes
Say's phoebe	*Sayornis saya*		No
Short-eared owl	*Asio flammeus*	BLM, PIF	No
Swainson's hawk	*Buteo swainsoni*	BLM, PIF	Yes
Turkey vulture	*Cathartes aura*		No
Vesper sparrow	*Pooecetes gramineus*	BLM, PIF	Yes
Western kingbird	*Tyrannus verticalis*		No
Western meadowlark	*Sturnella magna*		Yes
Western wood-peewee	*Contopus sordidulus*		No

[1] BLM = BLM Sensitive; BCC = USFWS Birds of Conservation Concern; PIF = Nevada Partners in Flight Priority Bird Species.

[2] Identified during baseline biological surveys in 2008 and 2009 or by NDOW personnel during surveys.

Sources: BLM 2008b; Floyd et al. 2007; Great Basin Ecology 2009; Neel 1999; SRK 2009b; USFWS 2008b.

Many of these species are associated with a variety of habitat types and some occur within the project vicinity year-round (e.g., red-tailed hawk, chukar, gray partridge). However, due to the higher level of plant diversity and structure, more abundant potential nest sites, and greater food base, the riparian zone along Boulder Creek supports the highest diversity of bird species within the study area.

Raptor species that potentially occur as residents or migrants within the study area include eagles (bald and golden eagles), hawks (e.g., red-tailed hawk, Swainson's hawk, ferruginous hawk), falcons (e.g., prairie falcon, American kestrel), owls (e.g., short-eared owl and burrowing owl), northern harrier, and turkey vulture (Floyd et al. 2007; Herron et al. 1985). Two raptor nests have been documented within the vicinity of the study area including a prairie falcon nest approximately 7 miles northwest of the study area and an American kestrel nest approximately 6 miles north of the study area (Miller 2010). No raptor nest sites have been found within the study area; however, formal raptor nest surveys have not been conducted in recent years within the area. In addition, a suspected raptor migration route occurs near the study area along the Tuscarora Mountains and Sheep Creek Range (Herron et al. 1985). As a result, raptor use within the study area may increase during spring and fall.

Details on sensitive bird species such as bald eagle, golden eagle, prairie falcon, ferruginous hawk, short-eared owl, vesper sparrow, and loggerhead shrike would be discussed further in Section 3.18, Special Status Species.

Reptiles

Several species of reptiles are known to occur within the study area including the Great Basin whiptail, bull snake, western rattlesnake, Great Basin collared lizard, desert horned lizard, western skink, and western fence lizard. These species occupy a wide variety of habitats and are most active during the summer and early fall months (BLM 2008b, 1993).

3.17.1.5 Aquatic Biological Resources

Habitat

Streams

Aquatic habitat within the study area consists of streams, wetlands, ponds, and springs within the Boulder Creek drainage. The study area is drained by three unnamed ephemeral streams (i.e., waterbody with water presence that is short-lived or transitory) that are tributaries to Boulder Creek (JBR Environmental Consultants, Inc. [JBR] 2009). These ephemeral streams generally are less than 2 feet wide. Stream substrates mainly consist of gravel and cobble. The Bell Creek area crossed by the haul road also is an ephemeral stream.

The mainstem of Boulder Creek is considered intermittent, since flow occurs on a periodic basis in response to snowmelt or major precipitation events. Typically, Boulder Creek flows in one or more months in March through July. The flow is lost through evapotranspiration before it reaches the Rock Creek Ditch (JBR 2009; Water Management Consultants, Inc. 1994). Further discussion of flow conditions in Boulder Creek is provided in Section 3.4.1.2, Surface Water Resources. In the vicinity of the study area, Boulder Creek is a cobble and boulder-dominated channel, with a mean width of approximately 8 feet. From the proposed project toward Rock Creek Ditch, Boulder Creek is braided and very flat, with estimated gradients of less than 1 to 5 percent (Cedar Creek 2009; JBR 2009). Widths of individual channels vary from less than 2 to 30 feet depending on the presence of flow and water volume (JBR 2009). Aquatic habitat is considered poor quality due to the limited flow and lack of diversity in terms of pools, riffles, and runs. If water is present, stream depths typically are quite shallow (less than 6 inches) except for peak runoff periods.

Wetlands

Approximately 5 acres of non-jurisdictional riparian zones and/or wetlands have been delineated within the study area at sites within the PoO boundary and where the Bootstrap Haul Road crosses Boulder Creek (**Table 3.14-2** and **Figure 3.14-4**). These small wetland areas provide aquatic habitat on a seasonal basis. In addition, a sediment pond and two seep areas (AR05 and AR17) provide aquatic habitat on a consistent basis throughout the year. Detailed discussion of wetlands is provided in Section 3.14.1.2, Riparian Zones and Wetland Areas.

Springs

Surveys conducted in the Boulder Creek drainage have identified several seeps or springs along Boulder Creek (BLM 1996b, 1993; Cedar Creek 2009), as discussed in Section 3.14.1.2, Riparian Zones and Wetland Areas.

Aquatic Communities

Based on studies conducted in Boulder Creek in 1975 (NDOW 1975) and from 1987 through 1992 (JBR 1993), the presence of aquatic biota reflects species that are able to colonize intermittent or ephemeral habitats. Due to a lack of perennial flow, fish are not present in the sections of Boulder Creek within the study area. Lahontan speckled dace (*Rhinichthys osculus robustus*) have been collected in the headwaters of Boulder Creek, which is located upstream of the study area (JBR 1988 as cited in BLM 2000c). In addition, speckled dace have been collected in Boulder Creek during a high water year such as 1989 (JBR 1993). When water is present in Boulder Creek, macroinvertebrate communities are characterized by low densities. The JBR surveys reported mean densities ranging from 187 to 1,452 individuals/meter^2 at three sampling locations. Although macroinvertebrate taxa were not reported in Boulder Creek, groups tolerant of intermittent or low flows in the lower portions of Rodeo and Brush creeks likely are present during periods when water occurs in Boulder Creek. These taxa include chironomid midges, ceratoponid (biting) midges, oligochaete worms, and ostracods.

Permanent and temporary waterbodies such as wetlands and springs also provide habitat for aquatic species. Lahontan speckled dace and snails were observed in the inlet to the BLM detention pond (AR09) in July 2010 (BLM 2010i). Invertebrate communities in these habitats depend on the type of water source (permanent or temporary), water chemistry, outflow discharge, substrate, aquatic vegetation, and other habitat features (Erman 2002). Although aquatic macroinvertebrate surveys have not been conducted in springs or wetlands within the study area, surveys in other Nevada springs provide an indication of composition. Five major macroinvertebrate groups typically are present in all types of springs including nematodes, oligochaete worms, water mites (*Acari* spp.), caddisflies (*Trichoptera* spp.), and chironomid midges. Several groups, such as flatworms and stoneflies, are present only in springs with permanent water sources. Erman's (2002) studies also showed that the highest number of taxa were associated with stable springs that maintained water levels throughout a long-term period.

Potential amphibian habitat occurs within the wetlands and intermittent and ephemeral stream reaches and springs within the study area. An amphibian survey was completed by BLM and NDOW on July 23, 2010, at wetland sites AR01, AR16, and AR17. No amphibians were found during the survey (BLM 2010i). Although amphibian species have not been observed within the Boulder Creek drainage, species such as the Pacific chorus frog (*Pseudacris regilla*) have been identified in adjacent drainages such as Brush and Bell creeks. This species uses stream reaches, ephemeral ponds, and wetlands for breeding and early life stage development. Breeding typically occurs in the late winter or spring. After the breeding season is complete, individuals disperse back to upland areas surrounding the waterbodies (Bernard 2010). Details on sensitive amphibian species such as the Columbia spotted frog and northern leopard frog are discussed in Section 3.18, Special Status Species.

3.17.2 Environmental Consequences

Terrestrial and aquatic aquatic biological resources related issues were determined through consultation with the BLM, NDOW, and USFWS. The primary issues related to terrestrial wildlife include loss or alteration of native habitats; increased habitat fragmentation; animal displacement; and direct loss of wildlife. The primary issues for aquatic biological resources include habitat alteration and the impacts of sedimentation on aquatic species due to surface disturbance activities; loss of habitat and species due to placement of waste rock; and potential spills from vehicle traffic and equipment during construction and operation phases of the project within the Boulder Creek drainage.

The potential impacts of the proposed project on terrestrial wildlife and aquatic biological resources can be classified as short-term (temporary) and long-term in duration. Short-term impacts arise from habitat removal and disturbance as well as from activities associated with mine operation; these impacts would cease upon mine closure and completion of successful reclamation. Long-term impacts consist of permanent changes to habitats and the wildlife and aquatic populations that depend on those habitats, irrespective of reclamation success.

3.17.2.1 Proposed Action

Wildlife Resources

Surface Disturbance

The proposed project would result in the long-term reduction of approximately 2,505 acres of wildlife habitat, including approximately 1,960 acres of sagebrush shrubland, 543 acres of grassland, and 2 acres of riparian zones and herbaceous wetland areas. Woody species such as sagebrush would require up to 25 years to reach maturity. The disturbance associated with the proposed project would be reclaimed following completion of mining activities, with the exception of 472 acres of shrubland, grassland, and wetland associated with the expansion of the existing open pit.

Direct impacts to wildlife from mine-related surface disturbance would include short-term and long-term reduction or loss of habitat. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and the displacement of more mobile species into adjacent habitats. In areas where habitats are at, or near, carrying capacity, animal displacement could result in some unquantifiable reductions in local wildlife populations. Mine-related surface disturbance also would result in an incremental increase in habitat fragmentation at the mine site until reclamation has been completed and vegetation re-established. Indirect impacts would include increased noise, additional human presence, and the potential for increased vehicle-related mortalities. The degree of the impacts on wildlife species would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activity, and physical parameters (e.g., topography, cover, forage, and climate).

The riparian habitat along Boulder Creek within the study area supports a greater number of species than other habitat types within the study area. As a result, it is anticipated that the potential mine-related displacement and habitat fragmentation impacts would be highest for wildlife species that use the riparian corridor along Boulder Creek.

Game Species

Potential direct impacts to mule deer would include the incremental long-term reduction of potential forage and the incremental increase in habitat fragmentation from vegetation removal associated with mine development activities. Displacement of big game, as a result of direct habitat loss and indirect reduction in habitat quality, has been widely documented (Irwin and Peek 1983; Lyon 1983, 1979; Rost and Bailey 1979; Ward 1976). Big game species tend to move away from areas of human activity and roads, reducing habitat utilization near the disturbance areas (Cole et al. 1997; Sawyer et al. 2006). Displacement distances are strongly influenced by the level and timing of human activity, topography, and the presence of vegetation (Cole et al. 1997; Lyon 1979), presumably due to noise attenuation and visual cover. Displacement of big game is greatest for heavily traveled secondary and dirt roads. Most research has focused on displacement distances for elk and deer. Displacement distances indicate the distance from the road's centerline where animal densities are less than in surrounding areas (i.e., under-utilized habitat). In most circumstances, elk were not observed to habituate to human activities. Deer and pronghorn appear to be more tolerant of human activities than elk. For deer, displacement distances ranged from 330 feet to 0.6 mile, depending on the presence of vegetative cover (Ward 1976). For evaluation purposes, 660 feet was the most common displacement distance used for deer, especially in areas with minimal vegetative cover. Deer and pronghorn have been observed to habituate to vehicles. Displacement distances decreased when traffic was predictable, moving at constant speeds, and was not associated with out-of-vehicle activities (Ward 1976). In addition, big game may experience increased mortality rates due to increased vehicle traffic on the Bootstrap Haul Road and Boulder Valley Road. Vehicular traffic may injure or kill individuals, and local populations may experience higher levels of mortality due to increased use of roads in the immediate project vicinity.

The project would disturb approximately 1,391 acres of limited use habitat consisting primarily of sagebrush shrubland habitat. This anticipated loss of habitat would result in an incremental reduction in the amount of available habitat in the study area. The reduction of available habitat increases the use of disturbed areas by mule deer during migration. This behavioral shift to negotiate disturbed terrain and avoid mining activities increases the animals physiological energy expenditures due to elevated stress levels.

Impacts to pronghorn would be similar to those discussed above for mule deer. Potential direct impacts would include the incremental long-term reduction of approximately 2,505 acres of summer habitat. Potential direct impacts to elk would include the incremental long-term reduction of approximately 1,940 acres of crucial winter habitat within the study area and approximately 19 acres of low-density habitat. However, unlike mule deer and pronghorn, elk prefer grasses to sagebrush and are, therefore, less susceptible to the effects of large scale fires. In fact, the conversion of large tracts of sagebrush habitat to grassland habitat favors elk and may lead to population increases and expansion into previously unoccupied habitat. Impacts to mountain lions are expected to be low, as this species occurs at a low density in and around the study area.

To reduce impacts from the proposed project on big game, particularly mule deer, measures outlined in the guidelines of the Area 6 Mule Deer Working Group Habitat Management Plan would be implemented to the degree practical to reduce activity near the north end of the West Waste Rock Disposal Facility (WRDF) during migration periods (i.e., spring and fall). In addition, these areas would be reclaimed as soon as possible to increase the width of the remaining migration corridor and to encourage use by mule deer and other big game.

Direct impacts to small game species (e.g., chukar, Hungarian partridge, mourning dove) would include the incremental long-term reduction of approximately 2,505 acres of potentially suitable habitat. Impacts also would include displacement from the disturbance areas and increased habitat fragmentation, until reclamation has been completed and vegetation is re-established. In most instances, suitable habitat adjacent to disturbance areas would be available for use by these species. However, displacement would increase competition and could include some local reductions in wildlife populations if adjacent habitats are at carrying capacity. Potential impacts also could include nest and burrow abandonment or loss of eggs or young. However, potential impacts to small game from mine development are expected to be low. These temporary losses would reduce productivity for that breeding season.

Nongame Species

Impacts to nongame species would be similar to those discussed above for small game species. Direct impacts to nongame species (e.g., small mammals, passerine, raptors, and reptiles) would include the incremental long-term reduction of approximately 2,505 acres of potentially suitable habitat. Impacts also would include displacement from the disturbance areas and increased habitat fragmentation, until vegetation is re-established. In most instances, suitable habitat adjacent to disturbance areas would be available for use by these species. However, displacement would increase competition and could result in some local reductions in wildlife populations if adjacent habitats are at carrying capacity. Potential impacts also could include nest and burrow abandonment or loss of eggs or young. However, potential impacts to nongame species from mine development are expected to be low. These temporary losses would reduce productivity for that breeding season.

Migratory Birds

A variety of resident and migratory bird species (e.g., raptors and songbirds) have been identified as potentially occurring within the study area. Potential direct impacts to bird species would include the temporary loss of approximately 2,505 acres of potentially suitable breeding, roosting, and foraging habitat. However, this temporary loss is expected to have little effect on local bird populations based on the amount of suitable breeding and foraging habitat in the surrounding area. In order to minimize impacts to raptors during the breeding season (March 1 to July 31), Barrick Dee Mining Venture (BDMV) has committed to conducting a breeding raptor survey and implementing appropriate mitigation measures, such as buffer zones around occupied nests, as needed. In addition, to protect other nesting bird species (e.g., passerines), removal of suitable habitat on currently undisturbed lands in the project area would be avoided to the extent possible between March 1 and July 31 to comply with the MBTA. Should removal of habitat be required during this period, BDMV would coordinate with the BLM and NDOW to conduct breeding bird surveys and implement appropriate mitigation, such as buffer zones around occupied nests, as needed. With implementation of these measures, residual impacts to nesting bird species within the study area would be limited primarily to temporary habitat loss. This loss is anticipated to have little impact given the extent of native habitats in the surrounding region.

As described in Section 2.3.6, Ancillary and Support Facilities, BDMV would construct new power transmission lines, a substation, and a power connection yard to accommodate project facilities. Power transmission lines pose an electrocution hazard for raptor species attempting to perch on the structures, as well as incrementally increase the collision potential for migrating and foraging bird species. However, collision potential typically is dependent on variables such as the location in relation to high-use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, species composition, visibility, and line design (Avian Power Line Interaction Committee [APLIC] 2006). As discussed in Section 2.3.9, Applicant-committed Environmental Protection Measures, BDMV has committed to design and construct power transmission lines in accordance with APLIC guidelines to minimize raptor electrocutions and collision potential.

Human Presence and Noise

The most common wildlife responses to noise and human presence are avoidance or accommodation. Avoidance would result in displacement of animals from an area larger than the actual disturbance area. The total extent of habitat loss as a result of the wildlife avoidance response is impossible to predict since the degree of this response varies from species to species and can even vary between individuals of the same species. Also, after initial avoidance of human activity and noise-producing areas, certain wildlife species may acclimate to the activity and begin to reoccupy areas formerly avoided. For example, during the initial development phases, it is likely that big game (i.e., pronghorn and deer) would be displaced from a larger area than the actual disturbance sites due to the avoidance response. However, these big game species have demonstrated the ability to acclimate to a variety of activities as long as human harassment levels do not increase substantially (Ward 1976). Therefore, it is possible that the extent of displacement would approximate the actual disturbance area after the first few years of mine operation (Ward 1976). In addition to avoidance response, increased human presence intensifies the potential for wildlife/human interactions ranging from harassment of wildlife to poaching and legal harvest.

Several factors would combine to minimize the potential impacts related to increased human presence in the study area. First, the proposed project is in the immediate vicinity of existing mine sites where human activity associated with mining operations continues to date. Second, to minimize wildlife/vehicle-related collision impacts during project operations, BDMV would require a mandatory employee education program for all personnel.

Water Management Activities

Wildlife populations within the study area could be affected by exposure to mine-related process solutions that may be present in ditches and ponds within the study area. To minimize impacts to wildlife from exposure to potentially toxic process solutions, BDMV has committed to constructing a BLM-approved 4-strand range fence, with 3-barbed strands and a smooth bottom strand, around the mine site to facilitate wildlife movement in the study area. In accordance with NDOW specifications, BDMV has also committed to constructing an 8-foot-high wire mesh fence around the process ponds as well as installing netting, pond covers, or floating "bird balls" as appropriate, over ditches and ponds that potentially contain toxic process solutions to minimize exposure of wildlife species, including volant (flying animals) and terrestrial wildlife species. In addition, the heap leach pads would be scarified to minimize ponding and pooling of process solutions.

A prospective screening-level ecological risk assessment (ERA) was conducted for the Arturo Mine Site (Arcadis 2010) to evaluate potential risk to ecological receptors from exposure to pit lake water and sediment in future open pits. The ERA was conducted in accordance with BLM Ecological Risk Assessment Guidelines for Open Pit Mine Lakes in Nevada (BLM 2004c) and United States Environmental Protection Agency (USEPA) Ecological Risk Assessment Guidance (USEPA 1998a, 1997b) to support the Environmental Impact Statement (EIS).

The goal of the ERA was to evaluate the potential for ecological risk (i.e., adverse impacts to biota from exposure to a stressor). Risk assessment at the screening-level stage is inherently conservative and utilizes conservative assumptions to eliminate those exposures that have no potential for adverse impacts. Reporting of potential risk does not imply that an adverse impact is present or likely to occur but rather indicates the need for further evaluation using other site-specific factors to refine the risk estimate.

Under the proposed project, development of the Arturo Mine would result in development of three pit lakes (North, South and East pit lakes) upon cessation of dewatering activities from the neighboring BGMI facility as described in Section 3.4 Water Resources and Geochemistry. For the purposes of the ERA, two permanent pit lake scenarios were assumed for each pit: a juvenile pit lake scenario (50 to 350 years after cessation of dewatering activities at the BGMI facility) and a mature pit lake scenario (approximately 400 years after the cessation of dewatering activities at the BGMI facility).

Biological development in the future pit lakes is dependent on physical characteristics, water chemistry, nutrient availability, and the regional environment. During the juvenile pit lake temporal scenario, rapidly rising water levels, pit wall erosion and sloughing, and high steep walls encompassing open water would limit access to the pit lakes by wildlife. Exposure to the pit lake environment during this juvenile stage is expected to be limited to migratory bird stop-over, and thus could provide a drinking water resource for birds and resting substrate for waterfowl. Once the pit lakes reach the mature scenario, small littoral and riparian zones may develop along the edges of the pit lakes. The mature pit lake environment could, therefore, attract a variety of wildlife and provide food (i.e., aquatic plants and invertebrates) and nesting substrates for wildlife. Fish could be present in the mature pit lakes if introduced by humans and could provide an additional food source for wildlife.

The ERA considered various representative indicator species that could conceivably utilize resources in the pit lakes. These include mammals (mule deer and little brown bat); birds (bald eagle, cliff swallow, killdeer, mallard, and western grebe); and fish (fish community). These species were selected as receptors to assess the juvenile pit lake environment because the other receptors are not reasonably expected to utilize the pit lakes during this stage of pit lake development. All receptors were considered for evaluation of the mature pit lake scenario.

Because the ERA is prospective, future pit lake surface water metals concentrations were modeled for each of the three proposed mine pit lakes based on pit lake water quality prediction modeling performed by Schafer Limited LLC (Schafer) (2012a). The maximum concentration for each target chemical, considering all three pit lakes and both temporal scenarios, was compared to the defined surface water screening criteria (Arcadis 2010) to determine chemicals of potential concern (COPC) to be further evaluated in the ERA. The following target analytes had maximum predicted water concentrations in excess of applicable criteria and were retained as COPC:

- Juvenile Pit Lake Scenario (50 to 350 years after cessation of dewatering) – cadmium, nickel, selenium, and zinc; and
- Mature Pit Lake Scenario (approximately 400 years after cessation of dewatering) – antimony, barium, cadmium, copper, nickel, selenium, and zinc.

Rock geochemistry data collected from the Arturo pits was used to estimate sediment concentrations for all COPC determined under the future mature pit lake scenario, where development of littoral sediment and associated benthic communities may be expected to occur. These sediment data and the modeled surface water concentrations were applied in the exposure model to estimate exposure to wildlife.

In the exposure assessment, a conservative deterministic dose model (USEPA 1993) was applied to the evaluation of birds and mammals to assess potential exposure to the selected representative species. Exposure dose was based on direct contact and ingestion of sediment and surface water and indirect contact via uptake of food/biota. Conservative biota-sediment accumulation factors and bioaccumulation factors were applied to account for the biotransfer of COPCs from food sources to wildlife. This approach yields conservative dose estimates, as it is assumed that the wildlife population obtains all or a majority of food and water resources from the pit lake environment, an unlikely scenario in view of the limited habitat expected to develop and the general inaccessibility of the pit lake environment.

In an additional step, the impact analysis, chronic toxicity reference values (TRVs), were derived for comparison to the estimated exposure doses calculated for each representative species in the exposure assessment; TRVs are literature-based chemical concentrations at or below which adverse effects are not expected. Upper bound (lowest observed adverse effect level [LOAEL]) and lower bound (no observed adverse effect level [NOAEL]) TRVs were derived, representing the highest dose that would not result in an adverse impact and the lowest dose above that may result in an adverse impact, per standard risk assessment practice. For the evaluation of the fish community, upper bound and lower bound effect benchmark TRVs were derived that are specific for fish: no observed effect concentrations (NOECs) and lowest observed effect concentrations (LOECs).

The screening-level ERA concluded that no unacceptable risk would be expected for wildlife receptors and the fish community in the proposed Arturo pit lakes. The potential for risk is expressed as a hazard quotient (HQ) equal to the exposure dose divided by the TRV, where $HQ \leq 1$ indicates that there is no potential for adverse impacts and a $HQ > 1$ suggests that the potential for risk cannot be excluded. Under the juvenile lake scenario, no HQ approached unity ($HQ=1$) and thus risk is not likely from pit water exposure under the juvenile pit lake scenario.

Under the mature pit lake scenario for wildlife, all upper bound risk estimates (HQ_{LOAEL}) were below unity, while lower bound risk estimate (HQ_{NOAEL}) for the killdeer marginally exceeded unity for selenium ($HQ=1.1$) based on exposure to water, sediment, and uptake of biota (food resources). The conservative assumptions required that the level of exposure be higher than reasonably expected. This includes an area use of 100 percent, which assumes year-round presence and use of the pit lake environment for all dietary and water resources, an unrealistic assumption. Considering that this and other assumptions (e.g., 100 percent bioavailability of COPC) are unrealistically conservative, the risk assessment concluded that exposure to Arturo mine pit lake media likely would not result in unacceptable risk to wildlife under anticipated future (mature) pit lake conditions.

The ERA also concluded that no unacceptable risk would be expected based on exposure of fish to pit lake COPC under the mature pit lake scenario. Based on comparison to literature-derived toxicity thresholds, all upper bound (HQ_{LOEC}) and lower bound (HQ_{NOEC}) risk estimates were at or below unity indicating that risk to fish would not be expected.

Shallow Initial Pit Lake Scenario

Prior to formation of the permanent pit lake scenarios described above, shallow ponding would occur in the early years following cessation of dewatering at the BGMI facility as described in Section 3.4 Water Resources and Geochemistry. Supplemental water quality predictions for the Proposed Action were estimated (Schafer 2011d) and evaluated to determine the potential for unacceptable risk to ecological receptors for a shallow pit lake that is expected to develop prior to the formation of the juvenile pit lakes. These shallow pit lakes would initially be seasonally intermittent or ephemeral water bodies that would be perched above the regional water table; eventually transitioning to perennial water bodies. It is assumed that these shallow pit lakes would form immediately after cessation of BGMI dewatering and would persist until the regional water table rebounds and intersects the pit shell, at which time rapid filling would occur as described for the juvenile pit lake scenario. Prior to rapid filling, the shallow initial pit lakes may provide water and food resources to biological resources similar to those described for the mature pit lake scenario.

Sedimentation and the progressive development of aquatic vegetation and associated benthic communities may be expected to occur over time during the shallow pit lake phase. The sediment concentrations predicted for the mature pit lake scenario based on the existing Arturo Pit geochemistry provide estimates of expected concentrations of metals in sediment. These sediment concentrations and the predicted surface water concentrations were evaluated by comparison to mature pit lake risk estimates, holding all other exposure variables constant.

The following target analytes had maximum predicted water concentrations in excess of applicable criteria and were retained as COPCs under the Proposed Action for the shallow intial pit lake scenario: antimony, barium, copper, nickel, selenium, and zinc. With the exception of antimony, copper and nickel, which were below predicted values for the juvenile pit scenario, modest increases in predicted water quality concentrations relative to the mature pit scenario were noted. These increases do not result in a potential for unacceptable risk to wildlife species obtaining water resources from the shallow pit lakes; water-based exposures represent less than 10 percent of the total ingested (dietary) dose for wildlife. However, zinc exceeded the surface water concentrations protective of fish: exceeded both threshold EC_{NOEC} (0.43 mg/L) and upper bound EC_{LOEC} (1.2 mg/L) values (Arcadis 2010). This exceedance suggests the potential for unacceptable risk to fish from exposure to zinc in the shallow initial pit lakes.

Hazardous Materials Spill

The probability of a transportation-related spill of process chemicals along the transportation route is discussed in Section 3.7, Hazardous Materials and Solid Waste. The potential for wildlife exposure to toxic chemicals as a result of a transportation-related spill would be greatest if an accident were to occur near aquatic habitats (e.g., Boulder Creek). Spills in dryland habitat would pose only minimal risk to most wildlife species since these spills would be adjacent to highways and could be rapidly contained and cleaned up. In general, the materials of greatest concern would be sodium cyanide, sodium hydroxide, and diesel fuel. The impacts of a sodium cyanide or sodium hydroxide release would be highly variable and would depend on the quantity released, the location of the release (e.g., dry upland area, wet meadow area, or flowing stream area), the species exposed, and the chemical conditions at the release location. The most likely impact of a potential release of sodium cyanide would be the poisoning of terrestrial or aquatic species. Animal species that drink contaminated water could suffer severe effects or death depending on the concentration of sodium cyanide and the volume of the water consumed. Sodium hydroxide has the potential to cause minor to extensive burns to exposed animals. A diesel spill has the potential to contaminate soil, surface water, and groundwater in addition to harming aquatic life and vegetation. Although unlikely, such a spill also could ignite from the accident and cause a range fire. Since cleanup actions would take place rapidly, diesel contamination has a low potential to result in long-term impacts to soil, surface water, and possibly groundwater. Hazardous chemicals would be transported via United States Department of Transportation-certified containers and transporters, and transportation of sodium cyanide and other chemical reagents would be in accordance with all applicable rules and regulations. In addition, as discussed in the PoO and Reclamation Permit Application (SRK 2009a), BDMV would implement their Spill Contingency Plan that establishes procedures for responding to accidental spills or releases of hazardous materials to minimize environmental risks.

Aquatic Biological Resources

Surface Disturbance

Direct impacts on aquatic habitat and species would involve disturbance to stream, wetland, or pond habitat as a result of activities within or near these waterbodies. Construction activities associated with the East WRDF and Septic Leach Field would occur in close proximity to Boulder Creek. In addition, the existing Bootstrap Haul Road would be widened to 140 feet including over crossings of Boulder Creek and Bell Creek as discussed in Section 3.14, Vegetation Including Riparian Zones and Wetland Areas. Other construction activities involving the expansion of the open pit, development of the West WRDF, and addition of a new heap leach facility would disturb soil from the drainage of Boulder Creek and catchment areas such as BLM retention pond AR09. These activities would result in soil disturbance and pose a risk of potential sediment input to the drainage. However, when considering the intermittent nature of Boulder Creek, sediment input to the drainage would be considered localized to areas near the proposed disturbance areas. Sediment could be dispersed during the snowmelt period or after storm events when stream flow is at its peak levels. However, these periods present a small portion of typical flow conditions during the year. Biological communities in Boulder Creek are limited to macroinvertebrates and attached algae that can tolerate intermittent flow and low water levels. The BLM retention pond contains Lahontan speckled dace. Applicant-committed environmental protection measures involving erosion and sediment control BMPs would be used to reduce sediment input from project facilities and disturbed areas into Boulder Creek, as defined by the site Storm Water Pollution Prevention Plan. By implementing the erosion control measures, project-related impacts of sediment on Boulder Creek and aquatic biota (when present) are considered to be minor.

The expansion of the pit also would result in the loss of three wetlands (designated as AR01, AR16, and AR17). One of these wetlands, AR17, has been observed to contain some standing water in the summer months. This wetland provides habitat for aquatic invertebrates and vegetation including algae and macrophyte (i.e., aquatic vegetation). No fish or amphibian species were observed in these three wetlands, based on a survey conducted in July 2010 (BLM 2010i). Two additional wetlands area would be disturbed where the Bootstrap Haul Road crosses Boulder Creek as shown in **Table 3.14-4**.

Water Management Activities

Water management activities would involve storm water control within the mine area. The system would be operated in a similar manner as the existing system. No impacts would occur to habitat along Boulder Creek and associated aquatic species.

Hazardous Materials Spill

Vehicle and equipment use in areas near Boulder Creek or wetlands such as AR09 and AR05 pose a risk to aquatic species from fuel spills or leaks reaching these waterbodies. If a spill occurred, the magnitude of the impact would depend upon the volume spilled and the extent of dispersal within the waterbody. If fuel entered a stream or wetland with flowing or standing water, adverse effects on aquatic species (mainly invertebrates) could occur depending on the variable factors involving spill volume and hydrology conditions in the waterbody. Spilled fuel products could result in mortalities to aquatic species, sublethal effects on physiological functions, or habitat degradation due to impacts on water quality. As part of applicant-committed environmental protection measures, BDMV would maintain and implement a Spill Prevention, Control, and Countermeasure (SPCC) Plan for petroleum products. The SPCC Plan would reduce spill risks to a low level. As a result, potential spill impacts on aquatic species and their habitat is considered of low likelihood.

3.17.2.2 Single Waste Rock Disposal Facility Alternative

Surface Disturbance

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of wildlife habitat disturbance, including approximately 84 fewer acres of limited use mule deer habitat, 128 fewer acres of pronghorn summer habitat and 35 fewer acres of elk crucial winter habitat. However, the expansion of the West WRDF under this alternative would extend the WRDF approximately 0.25 mile north of the proposed West WRDF footprint, into a known mule deer migration corridor as well disturbed 58 additional acres of elk low-density habitat. Due to the already restricted mule deer migration corridor from mining activities along the Carlin Trend, this alternative would result in adverse impacts to seasonal mule deer movements within the project area. All other direct and indirect impacts associated with this alternative would be similar to the Proposed Action.

Under the Single WRDF Alternative, effects to aquatic biological resources would be less in comparison to the Proposed Action. Potential adverse impacts to water quality and aquatic habitat from sediment input to Boulder Creek would be reduced from the elimination of the East WRDF. Although fuel usage would be greater under this alternative, spill risk to aquatic habitat and species would be the same as the proposed project because the access roads would not cross waterbodies.

Water Management Activities

Under this alternative, the potential risk to ecological receptors from exposure to pit lake water and sediment would be the same as described for the Proposed Action.

3.17.2.3 Partial Pit Backfill Alternative

Surface Disturbance

Under the Partial Pit Backfill Alternative, impacts to wildlife and aquatic biological resources would be the same as described for the Proposed Action, except that an additional 291 acres would be reclaimed in the open pit during final reclamation.

Water Management Activities

Results and conclusions of the prospective screening-level ERA conducted for the Proposed Action (Arcadis 2010) were reviewed and compared to surface water quality predictions generated for the Partial Pit Backfill Alternative to assess the potential for unacceptable risk to ecological receptors under this alternative. Biological development and resulting ecological exposures in the lake formed within the North Pit under the Partial Pit Backfill Alternative are not expected to differ substantially from the Proposed Action. Water quality predictions for this alternative for each of the two temporal scenarios (i.e., juvenile, Years 50 to 350 or shallow initial pit lake; and mature, Year 400 where a hydraulic steady state/hydraulic equilibrium is achieved) were reviewed relative to the predicted concentrations and risk assessment results reported for the Proposed Action.

Juvenile Pit Lake Scenario

Water quality predictions for the juvenile pit lake scenario for the Partial Pit Backfill Alternative were generated for comparison with the Proposed Action (Schafer 2011c,d). Under the Partial Pit Backfill Alternative, all predicted concentrations were below the concentrations presented for the Proposed Action considering all pits. Although quantitative differences in the risk estimate reported in the Proposed Action are indicated, there is no qualitative change in the risk assessment results or conclusions using the predicted water concentrations derived under this alternative scenario from those reported previously for the Proposed Action.

Mature Pit Lake Scenario

Assuming hydrologic steady state conditions at Year 400, predicted water concentrations for the Partial Pit Backfill Alternative were similar to the North Pit values reported for the Proposed Action. Sediment concentrations corresponding to the Partial Pit Backfill Alternative were not estimated but were assumed to remain the same as those reported for the Proposed Action mature lake scenario (based wall rock data collected from the Arturo pits). With few exceptions, North Pit lake Partial Pit Backfill Alternative water concentrations were below predicted Proposed Action concentrations. A limited number of COPC (i.e., barium and zinc) had higher predicted concentrations than predicted for the Proposed Action at Year 400; however, the North Pit lake Partial Pit Backfill Alternative values were only marginally elevated above these values (i.e., ≤2.2 times the North Pit Proposed Action predicted water quality concentration) (Schafer 2011d).

Of note is the Partial Pit Backfill Alternative predicted water concentration for zinc, which increased by a factor of about 2 over those predicted for the Proposed Action. Although small, this increase results in the potential for unacceptable risk to fish from exposure to zinc in surface water based on exceedance of the lower bound (NOEC based) threshold toxicity benchmark (EC_{NOEC}=0.43 milligrams per liter); whereas no potential for unacceptable risk was reported for the Proposed Action. The upper bound toxicity level (EC_{LOEC}) protective of fish was not exceeded. No other qualitative changes to the results and conclusions defined in the Proposed Action were noted.

Shallow Initial Pit Lake Scenario

Shallow pit lake water quality was predicted for the Partial Pit Backfill Alternative (Schafer 2011c, d) to determine the potential for unacceptable risk to ecological receptors for the shallow initial pit lakes expected to develop prior to the formation of juvenile pit lakes. Based on the expected ecological habitat conditions and predicted water quality for this alternative, the COPC were the same as those identified for the Proposed Action. All predicted shallow initial pit lake concentrations were at or below those concentrations estimated for the Proposed Action juvenile pit lake scenario. Although predicted water concentrations for barium, nickel and zinc were elevated relative to the values predicted for the Proposed Action mature pit lake scenario, the risk conclusions remain unchanged.

3.17.2.4 No Action Alternative

Surface Disturbance

Under the No Action Alternative, the proposed project would not be developed, and impacts to wildlife and fisheries resources would not occur. Under this alternative, approximately 2,505 acres of wildlife habitat would not be disturbed or lost, as described under the Proposed Action. Additional habitat fragmentation and animal displacement would not occur, limiting the impacts to wildlife resources to existing conditions. The level of human use would remain the same as the current levels. Completion of closure and reclamation activities associated with existing disturbance, and mineral exploration activities within the study area, would be conducted under existing authorizations.

New disturbance would not occur near Boulder Creek under the No Action Alternative. Therefore, potential sedimentation impacts on aquatic species and their habitat would not result under the No

Action Alternative. In addition, the loss of several wetlands containing aquatic habitat would not occur, since the pit would not be expanded and the Bootstrap Haul Road would not be widened. A low level risk of fuel spills on aquatic habitat would continue to exist for the No Action Alternative, although the SPCC Plan would be implemented to reduce spill risks.

Water Management Activities

Prior to formation of the permanent pit lake scenarios described above, shallow ponding would occur in the early years following cessation of dewatering at the BGMI facility as described in Section 3.4 Water Resources and Geochemistry. Supplemental water quality predictions for the Proposed Action were estimated (Schafer 2011d) and evaluated to determine the potential for unacceptable risk to ecological receptors for a shallow pit lake that is expected to develop prior to the formation of the juvenile pit lakes. These shallow pit lakes would initially be seasonally intermittent or ephemeral water bodies that would be perched above the regional water table; eventually transitioning to perennial water bodies. It is assumed that these shallow pit lakes would form immediately after cessation of BGMI dewatering and would persist until the regional water table rebounds and intersects the pit shell, at which time rapid filling would occur as described for the juvenile pit lake scenario. Prior to rapid filling, the shallow initial pit lakes may provide water and food resources to biological resources similar to those described for the mature pit lake scenario.

Of the remaining COPC, with the exception of antimony and copper, which were below previously predicted values, modest increases in predicted water quality concentrations relative to the mature pit scenario were noted. These increases do not represent a potential for unacceptable risk to wildlife species obtaining water resources from the lakes; water-based exposures typically represent less than 10 percent of the total ingested (dietary) dose for wildlife. However, nickel and zinc exceed the surface water concentrations protective of fish: nickel exceeds the threshold benchmark (EC_{NOEC}) only, and zinc exceeds both threshold EC_{NOEC} and upper bound EC_{LOEC} values. These exceedances suggest the potential for unacceptable risk from these metals to fish, if present, in shallow pit lakes.

3.17.3 Cumulative Impacts

The CESA for wildlife and aquatic biological resources is defined in Section 3.17.1, Affected Environment, and is shown in **Figures 3.17-1** through **3.17-4**. The past, present, and reasonably foreseeable future actions (RFFAs) in this area are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining are identified in **Table 3.2-1**, and their locations shown in **Figures 3.2-1** and **3.2-2**.

3.17.3.1 Proposed Action

Wildlife Resources

The CESAs for wildlife resources encompass a portion of NDOW's Management Area 6 (Hunting Units 062, 064, 067, and 068) as depicted in **Figures 3.17-1**, **3.17-2**, and **3.17-3**. The CESAs include a contiguous area that provides very important seasonal habitat for general wildlife species as well as mule deer and pronghorn. Cumulative impacts on wildlife in the CESAs have resulted primarily from wildfires, mineral exploration, mining activities, noxious weeds and non-native invasive plant species, livestock grazing, drought, urbanization, and seeding of native range with introduced herbaceous species (BLM 2010a,b). Other industrial development activities in the area such as a power plant, power transmission lines, and roads also contribute to impacts to wildlife (BLM 2010a,b). Development of reasonably foreseeable mine projects would continue to impact big game in their respective CESAs. However, most mine areas proposed for development within the Carlin Trend have been within or adjacent to existing mine areas (BLM 2010a,b).

Past, present, and RFFAs in the wildlife, mule deer, and pronghorn CESAs have resulted, or would result, in the direct disturbance of habitat (**Table 3.17-3**). A portion of the cumulative disturbance areas have been, or would be, reclaimed or have recovered materially (i.e., wildfire areas). The reclaimed areas, and areas associated with habitat conversion, would be capable of supporting wildlife use; however, species composition and densities may change. Overall, most of the local wildlife populations (e.g., big game, raptors, migratory birds, amphibians) that occur in the CESAs would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

Cumulative impacts to wildlife resources primarily would be directly related to habitat loss, habitat fragmentation, and animal displacement. Big game, especially mule deer, would be most susceptible to these cumulative impacts since encroaching human activities along the foothills of the Tuscarora Range and the Carlin Trend have resulted in animal displacement and habitat fragmentation in areas that are utilized as migration corridors between summer and winter ranges. NDOW collaring data has shown that mule deer tend to avoid large-scale mine disturbance areas along the Carlin Trend and choose specific routes through mine sites (e.g., BGMI facility, Bootstrap, Dee Gold/Rossi, Carlin Pit, Pete Pit). These routes are the remnants of the migration corridor in the Carlin Trend and are threatened by encroaching human activities and mine expansions.

Within the wildlife, mule deer, and pronghorn CESAs (**Figures 3.17-1** through **3.17-3**) mining has removed wildlife habitat, primarily as a function of fencing and/or land disturbance associated with mining operations. In addition, wildfire has created one of the primary cumulative impacts on these species. As shown in **Table 3.17-3**, from 1999 to late August 2008, thousands of acres of wildlife habitat have been impacted by large-scale wildfires. Wildfire has resulted in the temporary to long-term loss of shrubs that provide forage and cover as habitat components, which has caused reductions in mule deer and pronghorn herds throughout their respective CESAs. Impacts of wildfires to terrestrial wildlife species include loss of habitat (forage and cover), which can lead to mortality of mule deer and pronghorn, as well as other species. The loss of canopy cover and forb and grass diversity is prevalent across the burned areas, and the recovery of these plant communities would vary in terms of time and cover. In many areas, native shrub communities have been replaced by cheatgrass-dominated grasslands (Area 6 Mule Deer Working Group 2010; BLM 2010a,b). A breakdown of cumulative disturbance by the proposed project, wildfire, mining operations, and utility and energy development is presented in **Table 3.17-3**.

Nesting raptor species also would be susceptible to these cumulative impacts since encroaching human activities along the Carlin Trend have resulted in bird displacement and habitat fragmentation in areas that may be at their relative carrying capacity for these resident species.

Many of the local wildlife populations (e.g., small game, migratory birds) that occur in the CESA would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

Mine groundwater pumping activities within the CESAs may result in a reduction or loss of flows in springs and seeps that support wildlife habitat (i.e., riparian zones and wetland areas) (BLM 2010b). Reductions or elimination of flows in springs and seeps could impact wildlife species dependent on these sites (e.g., big game and bats).

Aquatic Biological Resources

The CESA for aquatic biological resources includes the Boulder Creek drainage located within the proposed mine boundary through Boulder Flat (**Figure 3.17-5**). The CESA also includes wetland areas with aquatic habitat such as AR09, AR05, and AR17. The proposed project would result in minor adverse impacts on aquatic biological resources in Boulder Creek as a result of surface disturbance

Table 3.17-3 Cumulative Wildlife, Mule Deer, Pronghorn, and Elk Habitat Disturbance

CESA and Habitat Type[1]	Total Acres of Habitat	Acres of Habitat Disturbed by Fire[2]	Acres Disturbed by the Proposed Action	Acres of Habitat Disturbed by Mining Operations (Past, Present, and RFFAs[3])	Acres of Habitat Disturbed by Utility and Energy Development (Past, Present, and RFFAs)	Total Acres of Habitat Disturbed
Wildlife	2,389,947	1,131,690 (47%)	2,505 (<1%)	38,622 (2%)	3,210 (<1%)	1,176,027 (49%)
Mule Deer – Limited Use	1,087,735	468,255 (43%)	1,391 (<1%)	31,448 (3%)	3,040 (<1%)	504,134 (46%)
Pronghorn – Summer	1,199,893	723,871 (60%)	2,505 (<1%)	36,452 (3%)	2,610 (<1%)	765,438 (64%)
Elk – Crucial Winter	256,765	183,622 (72%)	1,940 (<1%)	2,651 (1%)	2,610 (<1%)	190,823 (74%)
Elk – Low-density	776,312	496,482 (64%)	19 (1%)	23,348 (3%)	2,610 (4%)	522,459 (67%)

[1] Habitat types such as mule deer crucial winter habitat, and pronghorn crucial winter habitat are not impacted by the proposed project and, therefore, not included in the cumulative analysis.

[2] Fire data used for this analysis has been further refined and modified since the Betze Pit Expansion Supplemental EIS (BLM 2008).

[3] See **Table 3.2-1** for breakdown of mining projects.

Source: BLM 2011b; NDOW 2010a; U.S. Geological Survey 2005.

activities and low risk from potential fuel spills. There would be a loss of aquatic habitat in wetland AR17 as a result of pit expansion. The proposed project would not result in dewatering impacts within the CESA. These impacts would combine with other past, present, and RFFAs in the Boulder Creek drainage. Actions that have resulted in past or present disturbance include the Dee, Bootstrap, and the BGMI facilities. Erosion control measures have been required on these mining projects to reduce sediment input to Boulder Creek. However, collectively, these projects likely have resulted in some low level of sediment input to the drainage. High flow periods typically disperse the sediment to downgradient sections of the stream.

Other activities such as livestock grazing and agricultural development in the CESA would act cumulatively in adversely affecting aquatic biological resources. Potential cumulative effects to aquatic habitat and species include degradation of habitat from livestock grazing, conversion of native riparian/wetland plant communities to vegetation dominated by noxious weeds and non-native plant species, new roads, and in some cases agricultural diversions. Mitigation programs required for other mining developments are expected to reduce these potential impacts in the Boulder Creek watershed.

3.17.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the Single WRDF Alternative would be similar to wildlife resources discussed for the Proposed Action, except 128 fewer acres of wildlife habitat would be disturbed. Implementation of this alternative would result in greater cumulative impacts to seasonal movements of mule deer by further restricting a known mule deer migration corridor located in the northern-most portion of the study area. As a result, cumulative impacts to mule deer would be more pronounced under this alternative.

The cumulative impacts of the Single WRDF Alternative to aquatic biological resources would be similar to the Proposed Action, except potential sediment input to Boulder Creek and effects on aquatic habitat and species would be reduced due to the elimination of the East WRDF.

3.17.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative to wildlife and aquatic biological resources would be the same as discussed under the Proposed Action, except that an additional 291 acres would be reclaimed in the open pit during final reclamation.

3.17.3.4 No Action Alternative

Cumulative impacts to wildlife resources for the No Action Alternative generally would be the same as described for the proposed project. The exception would be 2,505 acres less habitat disturbance and reduced habitat fragmentation within the CESA associated with the No Action Alternative.

Under the No Action Alternative, potential sediment and fuel spill risks would continue to exist within the CESA. However, existing sediment-control and spill plans would be used to minimize impacts on the Boulder Creek drainage. These low level impacts would combine with other surface disturbance activities within the CESA.

3.17.4 Potential Monitoring and Mitigation Measures

The following mitigation measures are recommended for wildlife resources.

Issue: Development of the proposed project would affect approximately 1.6 acres of riparian and wetland habitat for wildlife species.

Mitigation Measure WL-1: In order to offset project-related impacts that would remove or disturb approximately 1.6 acres of riparian and wetland habitat for wildlife species, BDMV would install BLM-approved fencing around approximately 34 acres of wetland vegetation, including three springs, within the Water Canyon spring complex area, in coordination with the BLM as discussed in Section 3.14.4.2, Riparian Zones and Wetland Areas.

BDMV also would repair five pit reservoirs at the Water Canyon spring complex area by dredging sediment from the existing pit reservoirs and installing liners at the bottom of the reservoirs to retain water runoff from nearby springs.

Effectiveness: Implementation of this mitigation measure would offset project-related impacts to wetland vegetation by preventing livestock use within the fenced Water Canyon spring complex and enhancing existing wetland habitat within the project region. The mitigation measure also would improve an existing source of surface water for wildlife within the project region.

Issue: The proposed project would affect a mule deer migration corridor that connects important summer and winter range. Migration corridors in the Carlin Trend have been modified by large wildland fires that have converted sagebrush communities to a cheatgrass landscape, and by past and present mining operations. The implementation of the proposed project would further reduce habitat for migrating mule deer in the Carlin Trend.

Mitigation Measure WL-2: In order to reduce project-related impacts that would remove or disturb 1,391 acres of sagebrush shrubland habitat for migrating mule deer between important summer and winter range, Barrick Dee Mining Venture (BDMV) would restore and enhance important summer and winter mule deer range located on Bureau of Land Management (BLM) land immediately northwest of Boulder Valley along the southeast flank of the Sheep Creek Range at a ratio of 1:1, approximately 1,400 acres. The locations of possible restoration areas are shown in **Figure 3.17-9**. Restoration activities that would be used to restore important summer and winter mule deer range include, but are not limited to:

Seeding Treatments – Possible seeding treatments include broadcast and drag, drill, broadcast/aerial, harrow, disking, and hand.

Mechanical Treatment – To provide for an adequate seedbed, mechanical treatments would include disking (plowing), harrowing and mowing of existing grasses.

Livestock Grazing and Protective Fencing – Rest from livestock grazing.

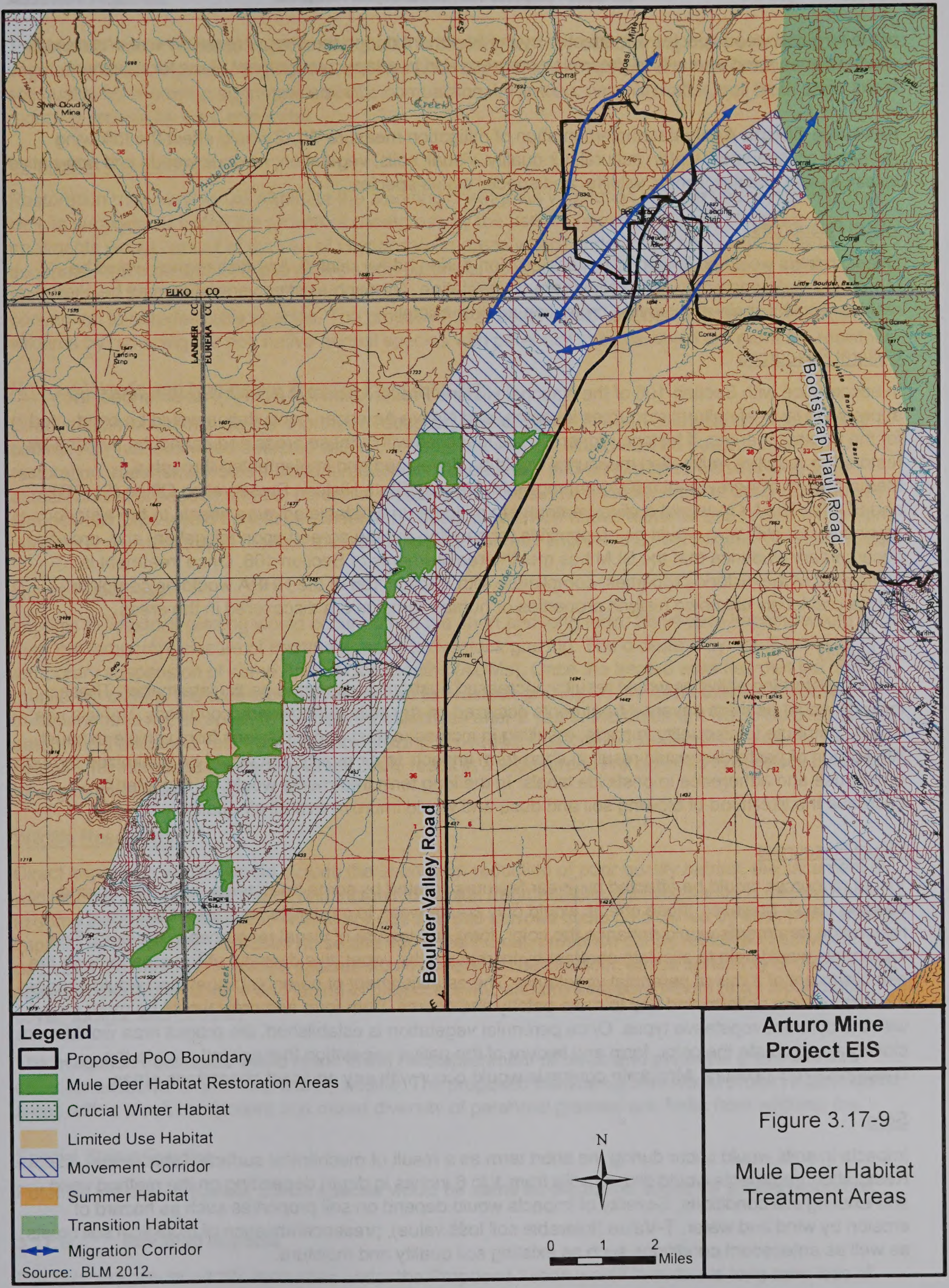
Herbicide Treatment – A combination of Imazapic and Glyphosate herbicide treatments would be used to suppress non-native annuals and crested wheatgrass in order to introduce shrubs, forbs and grasses into the treatment areas.

Prescribed Burn Treatments – Controlled burns would be use to reduce fuels, control competing vegetation, and improve wildlife habitat.

Restoration activities would occur within a 10-year period and would commence within 1 year of the initiation of project approval.

Effectiveness: Implementation of this mitigation measure would reduce project-related impacts to mule deer by restoring important summer and winter range within the CESA for this species. Monitoring programs would be developed and implemented to gauge the effectiveness of treatments and mitigation measures.

Vegetation rehabilitation treatments would be monitored using techniques outlined by the United States Geological Survey (USGS) in the *Strategy for Monitoring Post-fire Rehabilitation Treatments Handbook*. Treatment goals would be set on a site-by-site basis, taking into consideration site conditions pre-treatment, treatment method and species planted. Invasive species management treatments (including chemical, manual and mechanical treatments) would be considered effective if greater than 80 percent



Source: BLM 2012.

Arturo Mine Project EIS

Figure 3.17-9

Mule Deer Habitat Treatment Areas

05/16/2012

of the targeted weed species are affected by the treatment during the year. Infestation size and density would be measured annually to determine progress and to adapt management plans for treatment areas.

Resource Effects Analysis: Implementation of mitigation measure WL-2 would affect the following elements or resources: water, cultural, air quality, visual, soils, vegetation, noxious weeds and non-native invasive plant species, range, wildlife, and special status species.

Water Resources

Direct impacts would be limited to surface erosion during heavy rainfall. Any disturbance would be temporary and negated by reestablishment of vegetation. Although existing vegetation may be altered, a residue would remain and provide protection against rainfall.

Cultural Resources

In accordance with Section 106 of the National Historic Preservation Act (NHPA), as amended, the appropriate level of cultural resources inventory and Native American consultation would be conducted for the treatment areas. If historic properties are identified within these areas and cannot be avoided by restoration activities, mitigation measures would be developed and implemented through a Memorandum of Agreement (MOA) among BLM, Nevada State Historic Preservation Office (SHPO), and BDMV. The MOA would outline treatment to mitigate unavoidable adverse effects to the historic properties; identify who would be responsible for carrying out the agreed upon mitigation; and, provide documentary evidence that the BLM has met the requirements of Section 106. Once treatment is completed at the historic properties, compliance with Section 106 of the NHPA would be complete unless previously unknown historic properties or human remains are discovered in the areas.

Air Quality

Ground disturbing activities would result in increased dust and suspended particulate matter. These impacts would be more severe if treatments occurred on dry soils during windy conditions. Vehicle use would contribute to air quality impacts, resulting in increased dust and emissions from vehicle exhaust. Application of pesticides would result in short-term impacts to air quality, but would be minimized through proper use and adherence to pesticide labels. In the long term treatments would be expected to decrease the likelihood of blowing soil and dust, and would improve overall air quality.

Visual Resources

Visual resources would be affected by linear features created by some treatments (e.g., disking and seeding rows); however, these effects would only create weak to moderate contrasts. Overall, restoration treatments would enhance the color, form and texture of visual resources in the area. The treatments would help to alleviate contrast by increasing the vegetative diversity of the area through the establishment of a mix of perennial vegetation. The establishment of perennial vegetation would change the texture from uniform and fine to more patchy and coarse. Both form and color would be more varied with the different vegetative types. Once perennial vegetation is established, the project area would more closely approximate the color, form and texture of the native vegetation that existed prior to the cheatgrass monoculture. Moderate contrasts would occur with any adjacent cheatgrass areas.

Soils

Impacts to soils would occur during the short term as a result of mechanical surface disturbance. Restoration treatments would disturb soils from 1 to 6 inches in depth depending on the method used and existing soil conditions. Severity of impacts would depend on soil properties such as hazard of erosion by wind and water, T-Value (tolerable soil loss value), presence/absence of biological soil crusts, as well as antecedent conditions such as existing soil quality and moisture.

Treatments would indirectly improve soil quality in the long term by establishing more extensive vegetative cover. Vigorous vegetative canopies and root systems would provide numerous benefits for soil quality by improving aggregate stability, compaction, infiltration, organic matter, soil biota and reducing erosion by wind and water.

Vegetation Resources

Restoration treatment would eliminate the standing cheatgrass vegetation and the underlying thatch as well as suppress or inhibit the growth of cheatgrass by the use of chemicals means. Herbicide treatments would consist of the use of Glyphosate in areas where undesirable non-native annuals are dominate, and Imazapic in areas where some perennial vegetation exists. The treatments would help to restore many functions for the affected ecological sites and further reduce the risk of a permanent conversion to non-desirable species. The proposed treatments would reduce the potential for large wildfires by replacing the non native annual species with perennial species which are more fire resistant.

Noxious Weeds and Non-native Invasive Plant Species

Direct effects would include the short-term reduction of cheatgrass through chemical and mechanical control. Any noxious weed detected within the treatment window would also be treated. Overall, restoration treatments would include a reduction of cheatgrass and annual forbs with the long-term establishment of seeded shrubs, perennial grasses, and forbs. The establishment of perennial grasses, shrubs, and forbs would benefit the understory, out-compete non-native annuals, and create a more fire adapted ecosystem that is resilient to disturbance and thereby improve the Fire Regime Condition Class.

Range Resources

Impacts to livestock grazing would occur both in the short and long term. Short-term impacts would result from the temporary closure of treatment areas to livestock grazing. The closure may result in the temporary suspension of some Animal Unit Months (AUMs). Once the treated area has met the desired monitoring criteria, the area would be reopened to livestock grazing. In the event that the proposed treatment does not establish to the desired objectives after 2 years, the treatment would be evaluated to determine if additional rest from livestock grazing is needed. Restoration treatments would reduce the potential for increased fire cycles, which could result in a widespread fire closures to livestock closures throughout the allotments.

Wildlife Resources

Direct impacts to wildlife would include the short-term reduction of poor quality habitat, displacement by wildlife from the treatment areas, and increased habitat fragmentation until vegetation is re-established. In some instances, less mobile wildlife species that use burrows could be crushed by equipment. Indirect impacts would include increased noise and additional human presence during restoration activities. The degree of the impacts on wildlife species would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activity, and physical parameters (e.g., topography, cover, forage, and climate).

The mitigation treatments would result in the reestablishment of shrub and perennial grass and forb cover for seasonal or yearlong use by wildlife. The proposed treatments also would protect intact habitat areas with a shrub component and mixed diversity of perennial grasses and forbs from wildland fire.

Special Status Species

Potential impacts to Special Status species would be same as discussed above for wildlife resources.

3.17.5 Residual Impacts

Residual impacts to wildlife resources under the Proposed Action would include the long-term loss of 2 acres of riparian zones and wetland areas and 1,960 acres of sagebrush shrubland including the permanent loss of 472 acres of sagebrush shrubland and grassland habitat associated with the expansion of the open pit. The loss of shrub-dominated communities would represent a long-term change in wildlife habitat composition (i.e., shrub-dominated communities to grass/forb dominated communities) under the Proposed Action because it would take approximately 25 years for mature shrubs to become established in these communities.

Implementation of applicant-committed measures involving sediment control and the Spill Contingency Plan also would avoid residual impacts to aquatic habitat and species in the Boulder Creek drainage. The elimination of three wetlands associated with the open pit and two wetlands where the Bootstrap Haul Road crosses Boulder Creek would remove aquatic habitat, which would represent a residual impact on macroinvertebrates and plant communities that occur in waterbodies when water is present.

3.18 Special Status Species

3.18.1 Affected Environment

The study area for special status species includes the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and the power transmission line corridor, that occur outside of the proposed PoO boundary; and riparian, stream, spring/pond, and wetland habitats along Boulder Creek; and the haul road crossing at Bell Creek. The Cumulative Effects Study Areas (CESAs) for special status species, greater sage-grouse habitat, and greater sage-grouse preliminary priority habitat (PPH) and preliminary general habitat (PGH) extend from the northern end of the Independence Range northeast of the study area, south to the Humboldt River and the northern end of the Piñon Range (**Figures 3.18-1**, **3.18-2**, and **3.18-3**). Similar to the Wildlife CESA presented in Section 3.17, Wildlife and Aquatic Biological Resources, the Special Status Wildlife Species CESA and greater sage-grouse CESA are based on wildlife use within the project region and important seasonal habitats. The CESA for special status aquatic resources encompasses the Boulder Creek drainage located within the mine boundary as well as downgradient sections of Boulder Creek down to the Humboldt River (**Figure 3.18-4**). The rationale for selecting this CESA for special status aquatic species was based on the impact conclusion of negligible impacts on surface water resources beyond the Boulder Creek watershed (see Section 3.4, Water Resources and Geochemistry).

The study area for special status plant species is the same as described for vegetation in Section 3.14, Vegetation, Including Riparian Zones and Wetland Areas. No special status plant species have been identified as potentially occurring within the study area (Bureau of Land Management [BLM] 2010a; Nevada Natural Heritage Program [NNHP] 2010a; U.S. Fish and Wildlife Service [USFWS] 2010a). As a result, special status plant species have been eliminated from further discussion in this Environmental Impact Statement (EIS). State law under Nevada Revised Statute 527.060-527.120, regulates the commercial harvest, possession, transportation, and unlawful acts (removal, destruction, mutilation, or possession) of any cactus (*Cactaceae);* Christmas tree (i.e., evergreen trees); or member of the Yucca or Agave genera. These species may be present in the study area in low densities.

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the Endangered Species Act (ESA), and species designated as sensitive by the BLM. In addition, there is a Nevada State protected animal list (Nevada Administrative Code 501.100-503.104) that the BLM has incorporated, in part, into its sensitive species list.

In accordance with the ESA, as amended, the lead agency (BLM) in coordination with the USFWS must ensure that any action that they authorize, fund, or carry out would not adversely affect a federally listed threatened or endangered species. In addition, as stated in Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-125), it also is BLM policy "to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA provisions are no longer needed for these species, and to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA." The following discussion summarizes known data for the special status species identified for the proposed project by the applicable agencies.

A total of 46 special status species were identified as potentially occurring within the study area (Miller 2010, 2009; NNHP 2010a,b; USFWS 2010a). These species, their associated habitats, and their potential for occurrence within the study area are summarized in **Appendix B,** Special Status Species. Occurrence potential within the study area and CESAs was evaluated for each species based on their habitat requirements and/or known distribution. Based on these evaluations, 11 special status wildlife species have been eliminated from detailed analyses based on their habitat requirements and/or known distributions as discussed in **Appendix B,** Special Status Species. These species include the western red bat, river otter, northern goshawk, peregrine falcon, least bittern, sandhill crane, black tern, black-rosy finch, Lahontan cutthroat trout, interior redband trout, and Mattoni's blue butterfly. The remaining 35 special status wildlife species identified as potentially occurring within the study area are described below.

3.18.1.1 Mammals

Special Status Bat Species

Federal and state sensitive bat species that have been identified as potentially occupying appropriate habitat types within or near the study area are presented in **Appendix B,** Special Status Species. Bat species that could occur within the study area include the pallid bat, Townsend's big-eared bat, big brown bat, silver-haired bat, hoary bat, California myotis, small-footed myotis, long-eared myotis, little brown myotis, long-legged myotis, Yuma myotis, western pipistrelle bat, and Brazilian free-tailed bat. Marginal roosting and suitable foraging habitat is present in portions of the study area (BLM 1993; Bradley et al. 2006). Additional roosting habitat within the vicinity of the study area includes forested habitat and rock outcrops. Piñon-juniper woodlands adjacent to the study area may provide roosting habitat for some bat species. Higher elevation forest habitats and cliffs are present east of the study area in the Tuscarora Range and may provide potential roosting habitat for area bats.

Pallid Bat

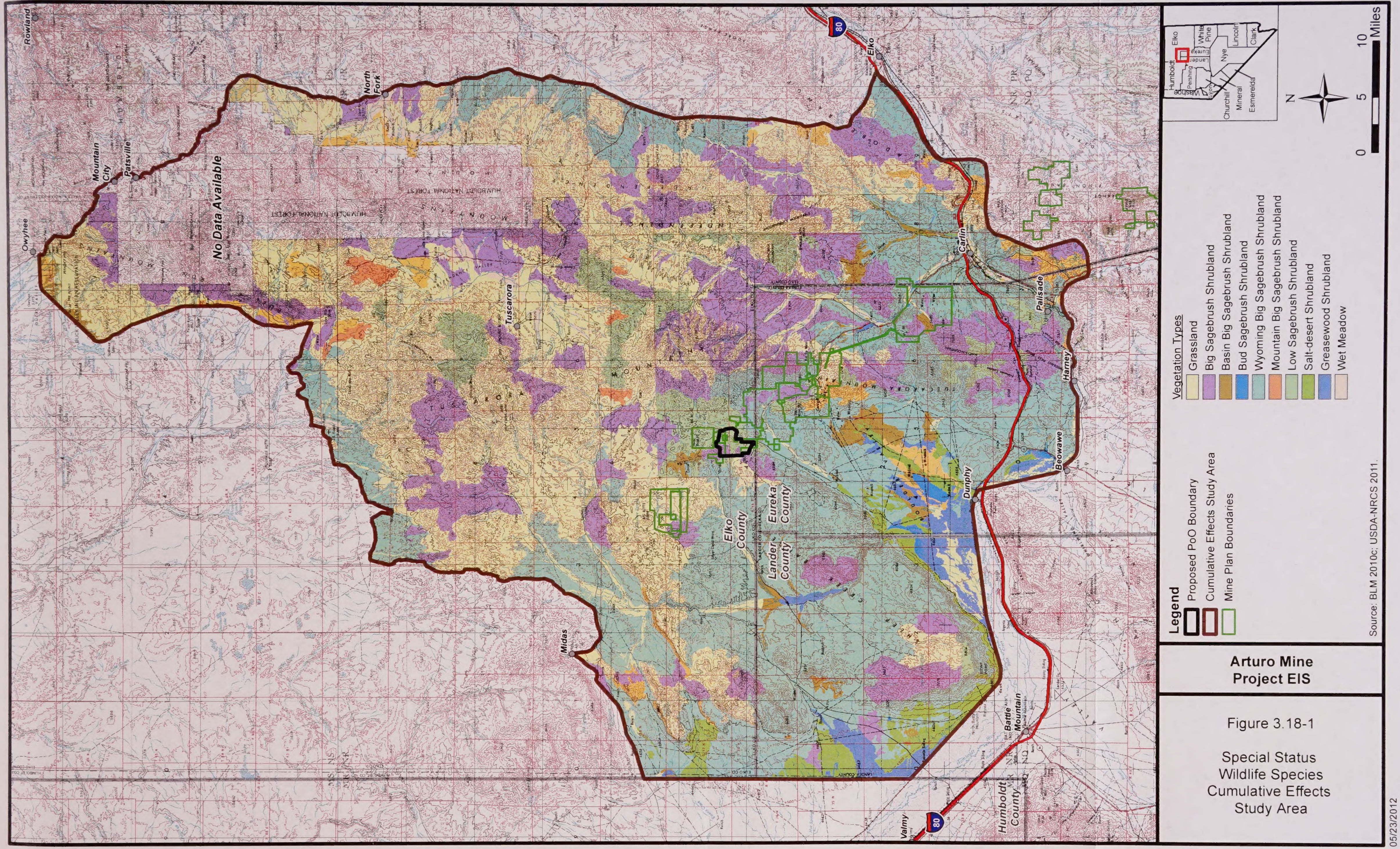
The pallid bat is a year-round resident in Nevada. Found primarily at low and mid elevations (1,300 to 8,400 feet above mean sea level [amsl]), this species occupies a variety of habitats such as piñon-juniper, blackbrush, cresote, sagebrush, and salt desert scrub (Bradley et al. 2006). This species feeds primarily on large ground-dwelling arthropods (e.g., scorpions, centipedes, grasshoppers), but also feeds on large moths (Bradley et al. 2006). The pallid bat is a colonial species, roosting in groups of up to 100 individuals (Arizona Game and Fish Department [AGFD] 1993). Roost sites consist of rock outcrops, mines, caves, hollow trees, buildings, and bridges (AGFD 1993; Bradley et al. 2006). The pallid bat is intolerant of roost sites in excess of 40 degrees Celsius (Bradley et al. 2006). This species has been documented southwest of the study area along Rock Creek and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Townsend's Big-eared Bat

The Townsend's big-eared bat is a year-round resident found throughout Nevada from low desert to high elevation mountain habitats (690 to 11,400 feet amsl). This bat primarily occurs in piñon-juniper, mountain mahogany, white fir, blackbrush, sagebrush, salt desert scrub, agricultural lands, and urban habitats (Bradley et al. 2006). This species prefers caves, mines, and buildings that maintain stable temperatures and airflow for nursery colonies, bachelor roosts, and hibernacula. It does not make major migrations and appears to be relatively sedentary, not traveling far from summer foraging grounds to winter hibernation sites. Its distribution seems to be determined by suitable roost and hibernation sites, primarily caves and mines (Harvey et al. 1999). This bat is believed to feed entirely on moths, which are gleaned from foliage and other surfaces (Bradley et al. 2006; Harvey et al. 1999). This species has been documented southwest of the study area along Rock Creek and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Big Brown Bat

The big brown bat is a year-round resident in Nevada. This species is found from low to high elevations (980 to 9,800 feet amsl) and occupies a variety of habitats including piñon-juniper, blackbrush, cresote,

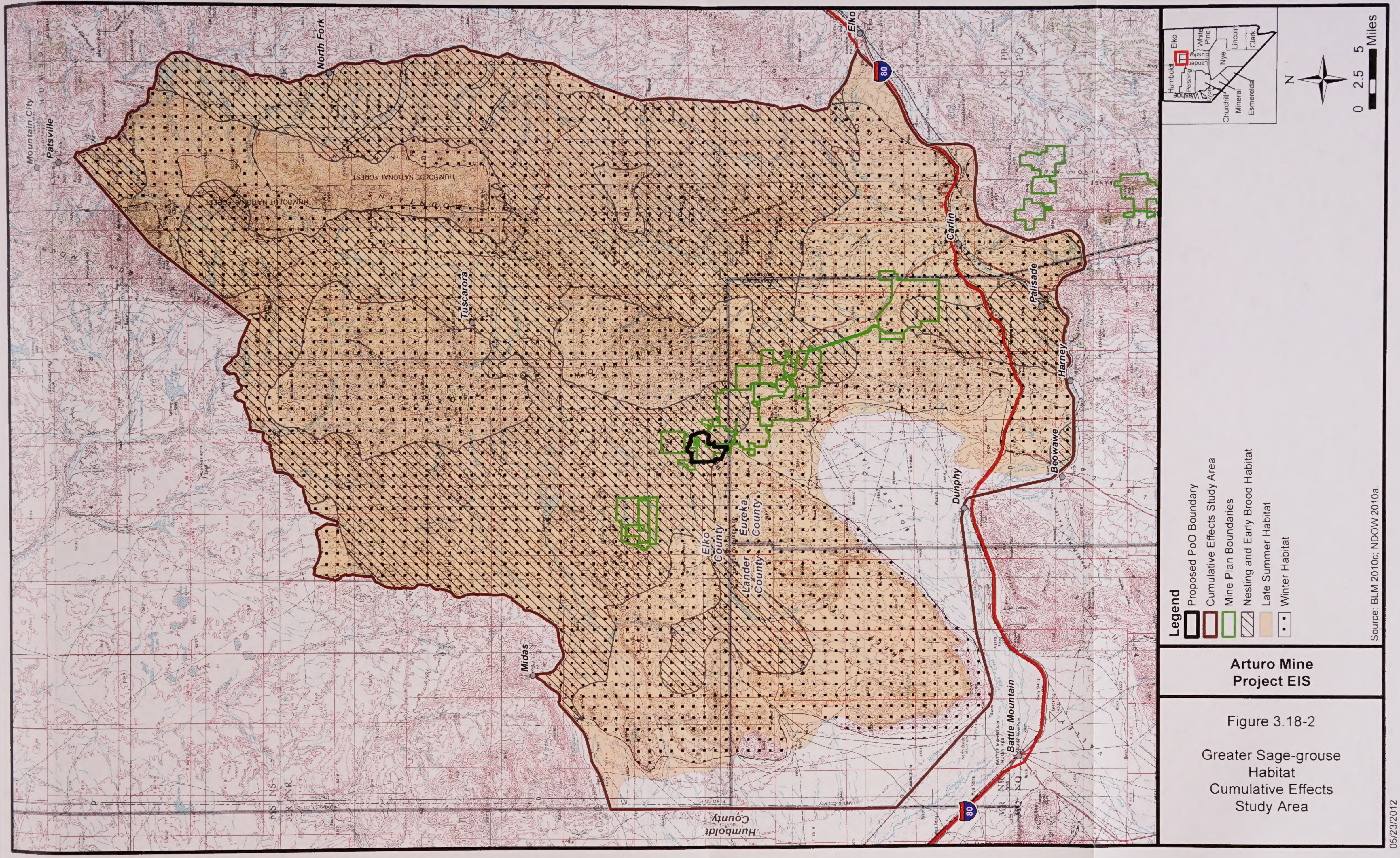


Source: BLM 2010c; USDA-NRCS 2011.

Arturo Mine Project EIS

Figure 3.18-1

Special Status Wildlife Species Cumulative Effects Study Area

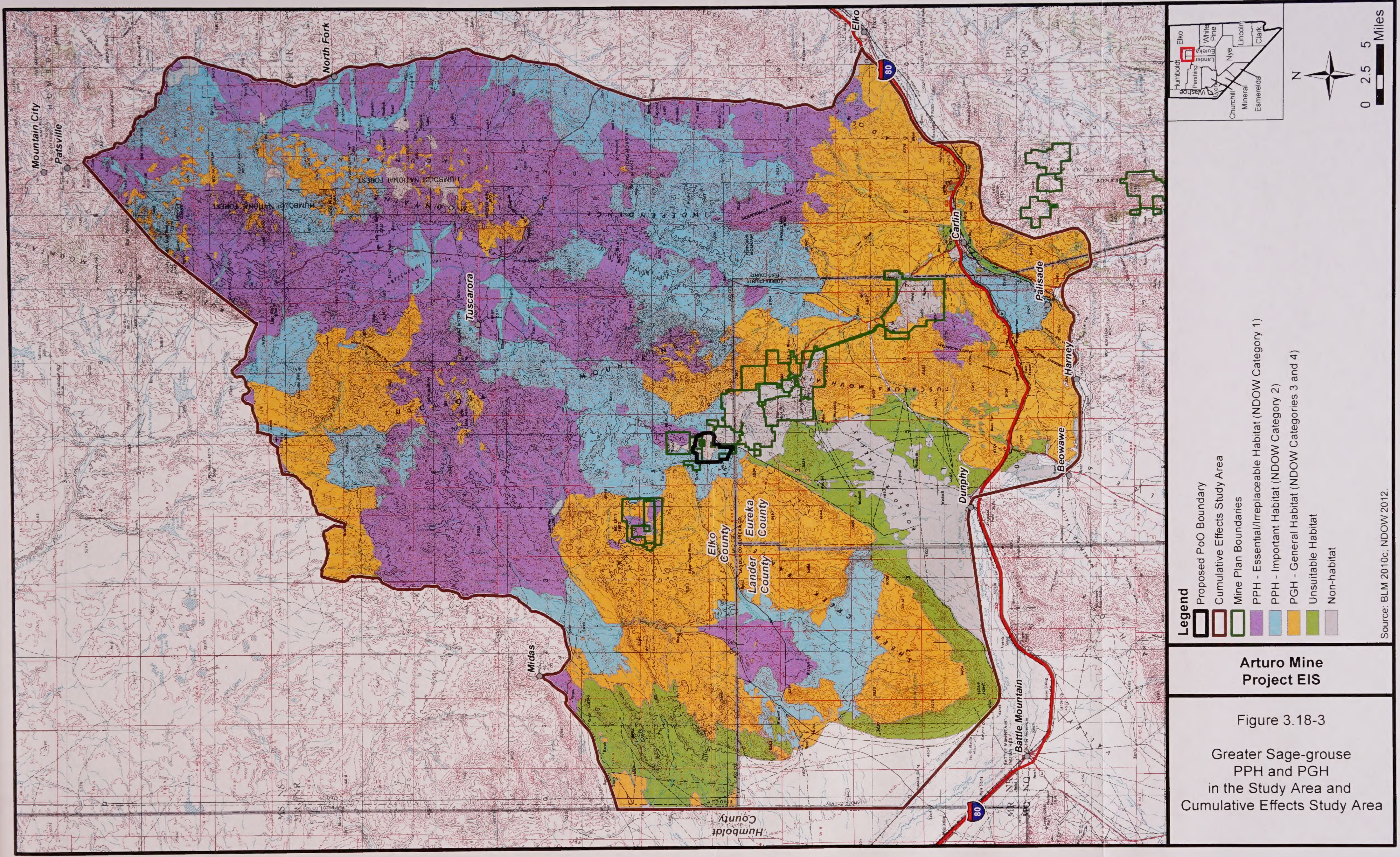


Source: BLM 2010c; NDOW 2010a.

Arturo Mine Project EIS

Figure 3.18-2

Greater Sage-grouse Habitat Cumulative Effects Study Area



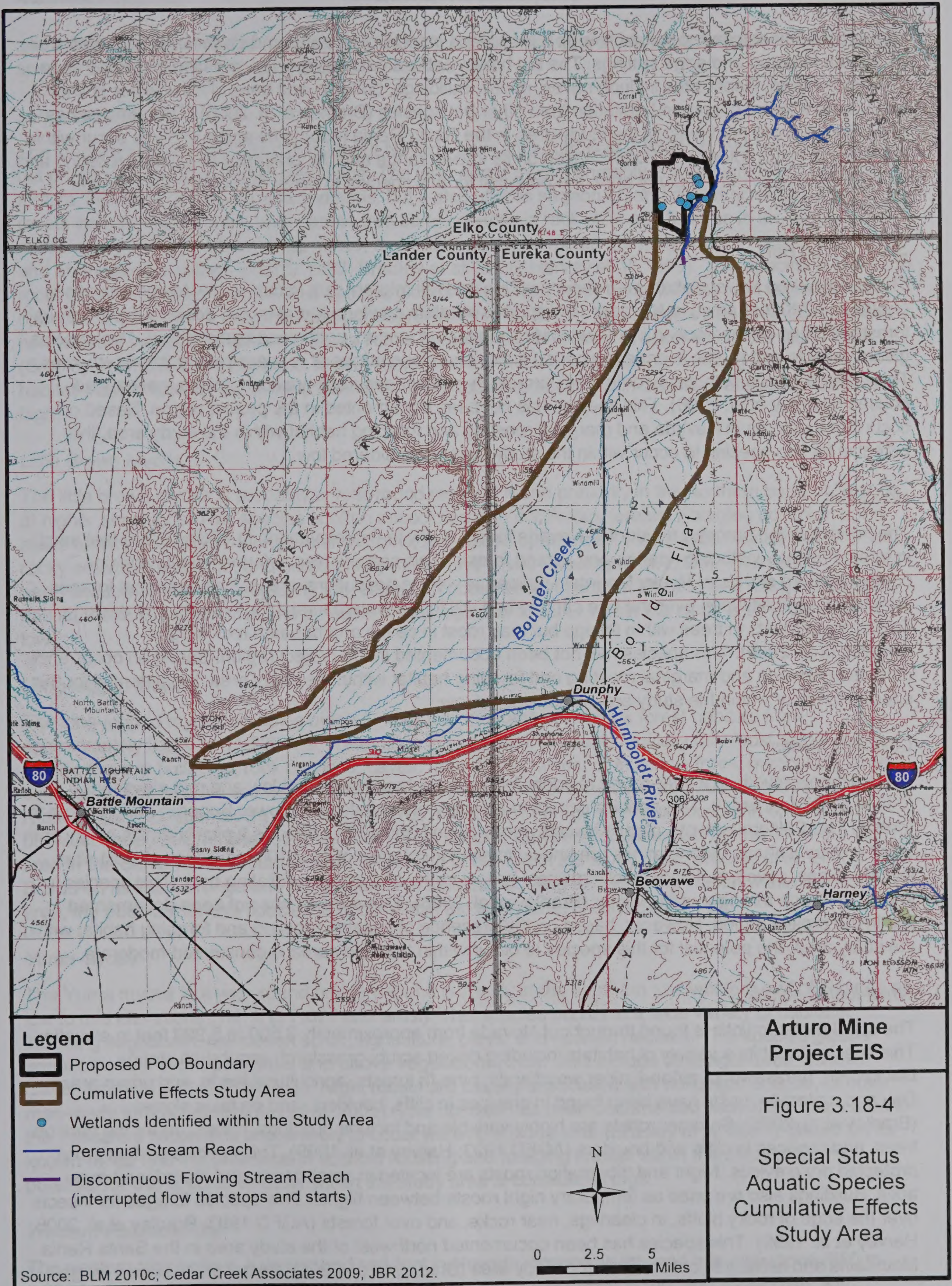
Source: BLM 2010c; NDOW 2012.

Arturo Mine Project EIS

Figure 3.18-3

Greater Sage-grouse PPH and PGH in the Study Area and Cumulative Effects Study Area

05/23/2012



Arturo Mine Project EIS

Figure 3.18-4

Special Status Aquatic Species Cumulative Effects Study Area

Source: BLM 2010c; Cedar Creek Associates 2009; JBR 2012.

05/16/2012

sagebrush, and salt desert scrub. This species gleans insects over water and open landscapes, as well as in both forested and edge settings. The big brown bat is a colonial species, roosting in groups up to several hundred. Roost sites include caves, mines, buildings, bridges, and trees. This species is known to be more tolerant of human habitation than other bat species (Bradley et al. 2006). This species has been documented northwest of the study area in the Santa Renia Mountains and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Silver-haired Bat

The silver-haired bat is probably a transient spring and fall migrant that occupies low to mid elevations (1,500 to 8,200 feet amsl) in Nevada. This species inhabits coniferous and mixed deciduous/coniferous forests of piñon-juniper, subalpine fir, white fir, limber pine, aspen, cottonwood, and willow. This species gleans insects and moths in or near wooded areas and along edges of roads, streams, or waterbodies. This species roosts both singly or in small groups in hollow trees, rock crevices, mines, caves, and houses (Bradley et al. 2006). This species has not been documented in the project region. Based on occurrence records in Nevada and marginal roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered low.

Hoary Bat

The hoary bat is a summer resident in Nevada found at low to mid elevations (1,870 to 8,200 feet amsl) in forest habitats, including riparian and upland forests. This species also is found in valley basins containing pure stands of Rocky Mountain juniper as well as agricultural areas. The hoary bat forages primarily at high altitudes over the tree canopy and will follow watercourses for foraging and drinking. This species roosts in trees within foliage but may roost in caves and beneath rock ledges (Bradley et al. 2006). This species has not been documented in the project region. Based on occurrence records in Nevada and marginal roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered low.

California Myotis

The California myotis is a year-round resident found throughout Nevada at low and mid elevations (689 to 8,957 feet amsl). This species occurs in a variety of habitats from Lower Sonoran desert scrub to forests. The California myotis gleans insects above open habitat. This species typically roosts singly or in small groups, although some mines are known to shelter colonies of over 100 individuals. Roost sites include mines, caves, buildings, rock crevices, hollow trees, and under exfoliating bark. This species is known to forage throughout the winter (Bradley et al. 2006). This species has not been documented within the project region. However, based on the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered moderate.

Small-footed Myotis

The small-footed myotis is found throughout Nevada from approximately 3,500 to 5,900 feet in elevation. This species inhabits a variety of habitats including desert scrub, grassland, sagebrush steppe, blackbrush, greasewood, piñon-juniper woodlands, pine-fir forests, agricultural lands, and urban areas. Day and maternity roosts have been found in crevices in cliffs, boulders, and on talus slopes (Bradley et al. 2006). Summer roosts are highly variable and include buildings, mines, under the bark on trees, and crevices in cliffs and boulders (AGFD 1993; Harvey et al. 1999). This species prefers small protected dry crevices. Night and hibernation roosts are located in small caves and abandoned mine adits. Buildings also are used as temporary night roosts between flights. This species forages for insects over the edge of rocky bluffs, in clearings, near rocks, and over forests (AGFD 1993; Bradley et al. 2006; Harvey et al. 1999). This species has been documented northwest of the study area in the Santa Renia Mountains and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Long-eared Myotis

The long-eared myotis is found throughout Nevada from approximately 2,260 to 6,790 feet in elevation but primarily is found at higher elevations. The long-eared myotis primarily is associated with coniferous forests, including piñon-juniper woodlands, but it also utilizes sagebrush and desert scrub habitats. Day roosts include hollow trees; under loose tree bark; crevices in rock cliffs and fissures in the ground; and occasionally in caves, abandoned mines, and buildings. Night roosts primarily occur in caves, mines, and abandoned buildings (AGFD 1993; Bradley et al. 2006; Harvey et al. 1999). This species is known to roost singly or in small groups. This species gleans insects (primarily small moths) over vegetation and open water (e.g., rivers, streams, and ponds) (Bradley et al. 2006). This species has been documented northwest of the study area in the Santa Renia Mountains and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Little Brown Myotis

The little brown myotis is probably a year-round resident found primarily in the northern parts of Nevada at higher elevations. This species is often associated with coniferous forests. Foraging occurs in open areas among vegetation, along water margins, and above open water. Roost sites include hollow trees, rocky outcrops, buildings, and occasionally mines and caves (Bradley et al. 2006). This species has not been documented in the project region. Based on occurrence records in Nevada and marginal foraging habitat within the study area, the potential for this species to occur within the study area is considered low.

Long-legged Myotis

The long-legged myotis occupies piñon-juniper and montane coniferous forest habitats from approximately 3,050 to 11,220 feet in elevation in Nevada. Individuals typically day roost singly or in small groups in buildings, rock crevices, caves, abandoned mines, or in hollow trees, particularly large diameter snags or live trees within lightning scars (AGFD 1993; Bradley et al. 2006; Harvey et al. 1999). Night roosts and hibernacula are often in caves and mines. Foraging typically occurs in open areas, often at canopy height (Bradley et al. 2006). This species has been documented northwest of the study area in the Santa Renia Mountains and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Yuma Myotis

The Yuma myotis is a year-round resident found primarily in the southern and western half of Nevada at low to mid elevations (1,476 to 7,677 feet amsl). This species occurs in a wide variety of habitats, including sagebrush, salt desert scrub, agriculture, playa, and riparian habitats. This species gleans aquatic insects over open water and above vegetation. Roost sites include buildings, trees, mines, caves, bridges, and rock crevices. Night roosts are usually associated with buildings, bridges, or other man-made structures (Bradley et al. 2006). This species has been documented east of the study area in the Tuscarora Mountains and is likely to occur within the study area (Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Western Pipistrelle Bat

The western pipistrelle is a year-round resident in Nevada, occupying low and mid elevations (680 to 8,200 feet amsl) in desert habitats of blackbrush, creosote, salt desert scrub, and sagebrush, with occasional occurrence in ponderosa pine and piñon-juniper, usually in association with rock features such as granite boulders and canyons. This species gleans insects over open habitats. This species roosts both singly or in small groups in mines, caves, or occasionally in buildings and vegetation. This species has been documented southwest of the study area along Rock Creek and is likely to occur within the study area (BLM 2008b; Bradley et al. 2006). Based on its known range and the presence of suitable roosting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Brazilian Free-tailed Bat

The Brazilian free-tailed bat is found throughout Nevada in a wide variety of habitats ranging from desert scrub to high elevation mountain habitats (680 to 8,200 feet amsl). This species roosts in a variety of structures including cliff faces, caves, mines, buildings, bridges, and hollow trees. Some caves are used as long-term transient stopover roosts during migration. The Brazilian free-tailed bat is known to travel long distances to foraging areas and often forages at high altitudes. This species has not been documented within the project region. The nearest record is approximately 25 miles southeast of the study area along the Humboldt River near Elko, Nevada (Bradley et al. 2006). Based on the presence of suitable foraging habitat within the study area, the potential for this species to occur within the study area is considered moderate.

Preble's Shrew

The Preble's shrew is found in a wide variety of habitats in Nevada including arid grasslands and shrublands, wetland and forest edges, and alpine tundra. This species is active year-round and may be active at any time throughout the day or night, but is probably most active during morning and evening hours (Wildlife Action Plan Team 2006). This species most likely resembles other shrews, feeding primarily on insects and other small invertebrates such as worms, mollusks, and centipedes (Wildlife Action Plan Team 2006). The Preble's shrew has been documented approximately 25 miles northeast of the study area near Sheep Creek and suitable habitat occurs within the study area (Ports and George 1990). The potential for this species to occur within the study area is considered high.

Fletcher Dark Kangaroo Mouse

This species is found throughout Nevada in a wide variety of habitats including intermountain desert scrub, sagebrush grasslands, badlands, desert playas, and ephemeral pools. This species' primary food source is seeds, but it also may eat insects. It does not appear to utilize free water and is believed to store food in seed caches within burrow systems. Activity for this species has been observed from March through October, with peak nocturnal activity occurring in the first 2 hours after sunset (Wildlife Action Plan Team 2006). This species has been recorded in Elko County approximately 55 miles east of the study area near Halleck, Nevada (O'Farrell and Blaustein 1974). Based on the presence of suitable habitat within the study area, the potential for this species to occur within the study area is considered high.

Pygmy Rabbit

The pygmy rabbit is distributed throughout the northern Great Basin, primarily in habitats dominated by dense stands of big sagebrush and rabbitbrush. This species is most abundant in areas with suitable soils (e.g., high clay content) for burrowing. Pygmy rabbits usually remain near dense cover, where they excavate burrows and create trail systems in the understory. Sagebrush is important forage for this rabbit and is consumed year-round (BLM 2004b). This species has been recorded within 5 miles of the study area and suitable sagebrush habitat occurs in portions of the study area (Great Basin Ecology 2009; Miller 2009). The potential for this species to occur within the study area is considered high.

3.18.1.2 Birds

Bald Eagle

The bald eagle is found throughout Nevada, but mainly as a migrant and winter resident (Floyd et al. 2007; Herron et al. 1985). This species generally roosts in close proximity to large water bodies including rivers, lakes, and reservoirs (Johnsgard 1990; Wildlife Action Plan Team 2006). Nests are typically large stick nests located in large trees such as cottonwoods. Bald eagles typically begin nesting in February and young fledge by July (Herron et al. 1985). This species has been documented within the project region and during winter surveys within the sub-basins of Rock, Boulder, and Maggie creeks (BLM 2008b). However, due to the lack of suitable habitat (i.e., large trees near waterbodies) within the study area, occurrences would be limited to migrating and foraging individuals. Therefore, the potential for this species to occur within the study area is considered moderate.

Swainson's Hawk

The Swainson's hawk is a summer resident of Nevada and is most abundant in the northern third of the state (Floyd et al. 2007; Herron et al. 1985). The majority of documented breeding territories in Nevada have been located in agricultural valleys. This species nests in a wide variety of vegetative communities from 4,000 to 6,500 feet in elevation. Nest sites primarily are found in deciduous trees; however, nests also have been documented in other vegetation types such as buffaloberry, serviceberry, and sagebrush. Swainson's hawks begin nesting in April and young typically fledge by July (Herron et al. 1985; Johnsgard 1990). This species is known to nest south of the study area along the Humboldt River (Herron et al. 1985). No nest sites have been documented within the study area. However, based on the presence of suitable foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Ferruginous Hawk

The ferruginous hawk is a common breeder in many areas of Nevada, particularly the central and east-central portions of the state (Floyd et al. 2007; Herron et al. 1985). This species often nests in trees, on promontory points, rocky outcrops, cut banks, or on the ground. Preferred breeding habitat in most of the state is scattered juniper forests at the interface between piñon-juniper and desert shrub communities that overlook broad valleys used for foraging. Ferruginous hawks begin nesting in March and young fledge by July (Herron et al. 1985; Johnsgard 1990). No nest sites have been documented within the study area. However, based on the presence of suitable nesting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Golden Eagle

The golden eagle is a yearlong resident and is considered to be a common breeder throughout Nevada; however, eagle densities and nesting activity are greatest in the northern third of Nevada (Floyd et al. 2007; Herron et al. 1985). Nesting golden eagles prefer suitable cliffs that overlook sagebrush flats, piñon-juniper forests, salt desert shrub, or other habitat capable of supporting a suitable prey base. The highest densities of nesting eagles typically are found along river systems where cliffs border the entire length of the river, and lower densities are found in piñon-juniper habitat and salt desert shrub communities. Golden eagles begin nesting in March and young fledge by July. Wintering golden eagles tend to congregate in broad valleys interspersed with agricultural croplands or sagebrush and desert shrub communities (Herron et al. 1985; Johnsgard 1990). No nest sites have been observed within the study area. However, this species has been observed in the project region (BLM 2008b). Based on the presence of suitable foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Prairie Falcon

Prairie falcons range throughout the Great Basin and are permanent residents of Nevada. Habitat requirements include steep cliff ledges and outcrops for nesting that border semi-arid valleys. The highest nesting densities in Nevada occur in northern counties, particularly located in or near the mouth of narrow canyons, overlooking riparian vegetation and agricultural lands. Prairie falcons begin nesting in March and young typically fledge by July (Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990). The nearest known prairie falcon nest occurs approximately 7 miles north of the study area (Miller 2009). However, based on the presence of suitable foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Greater Sage-grouse

The greater sage-grouse is found throughout Nevada in sagebrush dominated habitats (Floyd et al. 2007). Sagebrush is a key component of greater sage-grouse habitat on a yearlong basis. Sagebrush provides forage and nesting, security, and thermal cover for this species. Moist areas that provide succulent herbaceous vegetation during the summer months are used extensively as brood rearing habitat. Open, often elevated areas within sagebrush habitats usually serve as breeding areas (strutting grounds or lek sites). In Nevada, greater sage-grouse males begin displaying on leks in March and hens typically begin nesting in April and May. During winter, greater sage-grouse often occupy wind exposed areas where sagebrush is available (e.g., drainages, southern or western slopes, or exposed ridges) (Connelly et al. 2000; Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). Based on Nevada Department of Wildlife (NDOW) records, the closest active greater sage-grouse lek occurs approximately 3.5 miles north of the study area (Miller 2009). While no leks occur within the study area, greater sage-grouse nesting, summer, and winter habitat is found throughout the study area (**Figure 3.18-5**). Approximately 1,809 acres of undisturbed (i.e., unburned) nesting, early brood, and late summer and winter habitat occur within the study area.

In addition to the NDOW designated habitat categories described above, the BLM has recently issued additional guidance on greater sage-grouse management. According to BLM Instruction Memorandum 2012-043, two habitat categories have been developed by the BLM and NDOW to help apply management guidelines designed to protect greater sage-grouse habitat. These habitat types are referred to as PPH and PGH. PPH comprises areas that have been identified as having the highest conservation value to maintaining sustainable greater sage-grouse populations. PPH comprises essential/irreplaceable habitat and important habitat (NDOW Categories 1 and 2) (note: these characterizations are preliminary and subject to change). PPH includes breeding, late-brood rearing, and winter concentration areas. Approximately 1,516 acres of PPH - important habitat occurs within the study area (**Figure 3.18-6**). PGH comprises habitat of moderate importance, low value habitat, or transitional habitat outside of priority habitat (NDOW Categories 3 and 4) (note: these characterizations are preliminary and subject to change). PGH does not occur within the study area. Due to the presence of suitable habitats, this species may occur occasionally within the study area. Therefore, the potential for this species to occur within the study area is considered moderate.

Long-billed Curlew

The long-billed curlew is known to breed at Sheldon National Wildlife Refuge in northern Washoe County, Ruby Lake National Wildlife Refuge in Elko County, Lahontan Valley in Churchill County, and Fish Creek Ranch in Eureka County. This species prefers short grasslands, wet meadows, wetlands, and marshes (Floyd et al. 2007; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Limited habitat occurs within the study area but this species was observed in the study area in the spring of 2011. Therefore, the potential for this species to occur within the study area is considered high.

Western Yellow-billed Cuckoo

The western yellow-billed cuckoo is known from only a few locations in Nevada. This species has undergone dramatic population declines throughout western North America due to a loss of native riparian habitats. The yellow-billed cuckoo preferred habitat is old-growth riparian woodlands with a dense understory component (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The

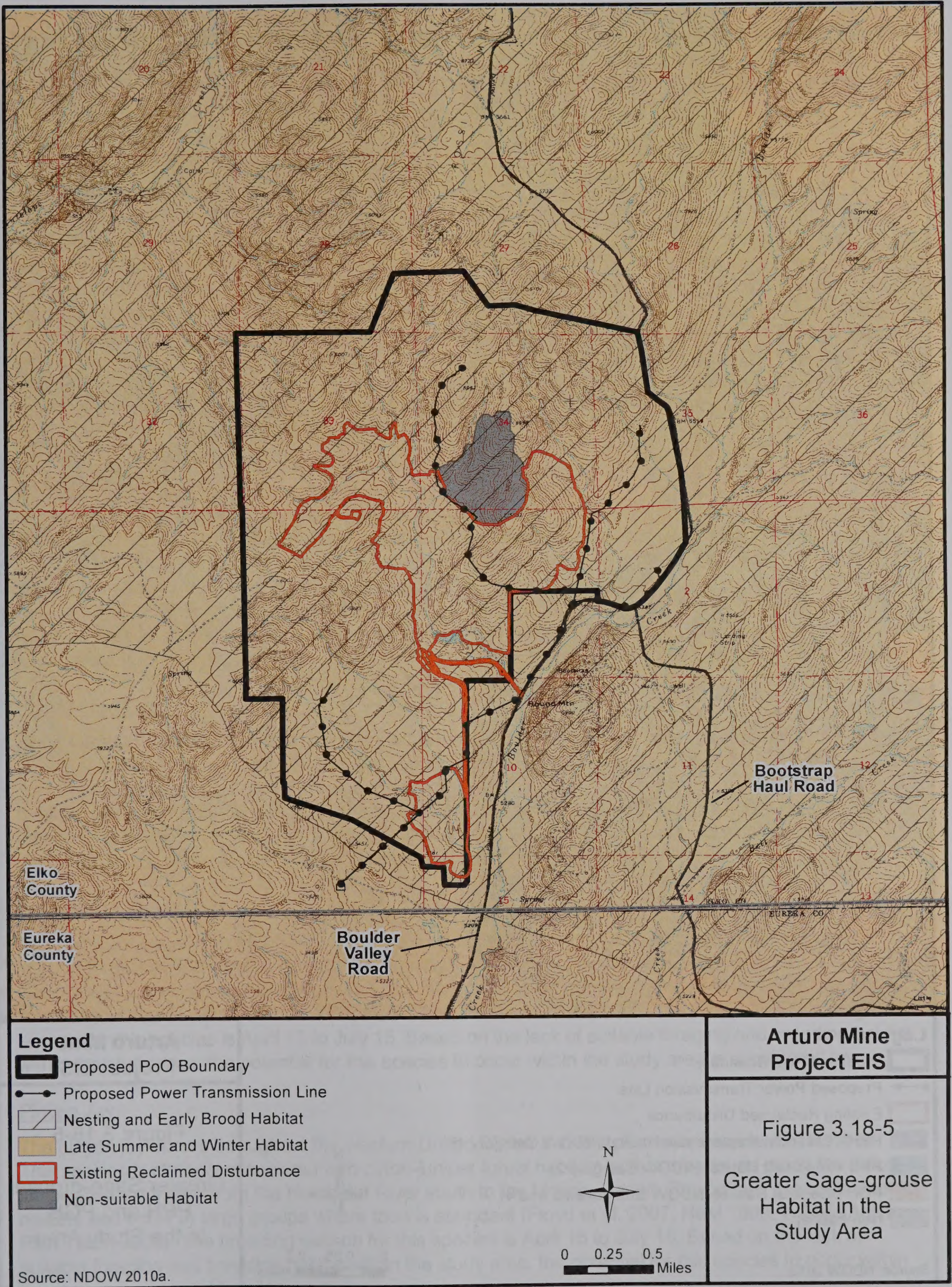
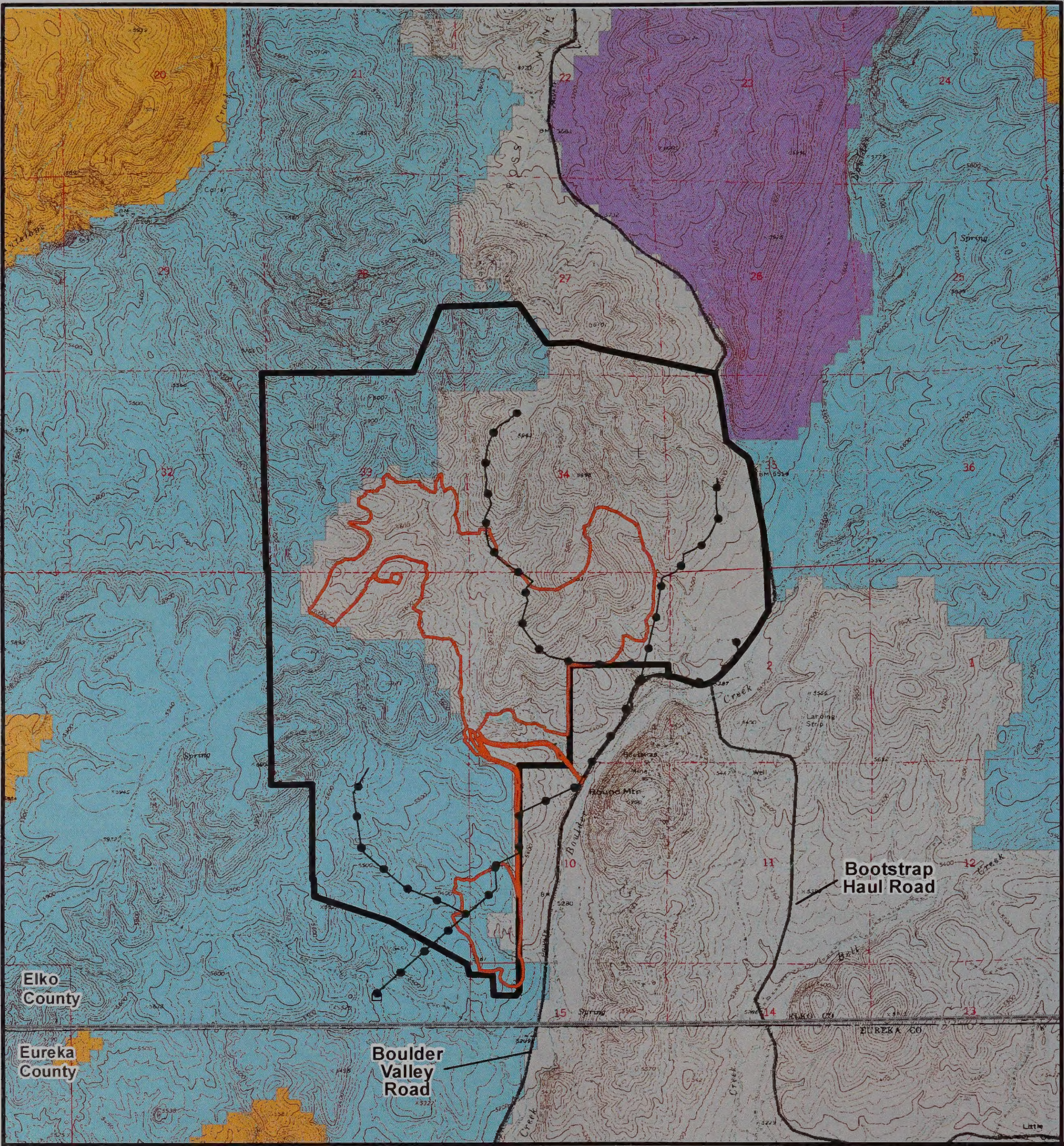


Figure 3.18-5

Greater Sage-grouse Habitat in the Study Area

Source: NDOW 2010a.

05/24/2012



Legend

▭ Proposed PoO Boundary

●—● Proposed Power Transmission Line

▭ Existing Reclaimed Disturbance

🟪 PPH - Essential/Irreplaceable Habitat (NDOW Category 1)

🟦 PPH - Important Habitat (NDOW Category 2)

🟧 PGH - General Habitat (NDOW Categories 3 and 4)

⬜ Non-habitat

Source: NDOW 2012.

Arturo Mine Project EIS

Figure 3.18-6

Greater Sage-grouse PPH and PGH in the Study Area

05/17/2012

breeding season for this species is April 15 to July 15. Occurrence records are limited for Nevada and are mainly concentrated in the southern portion of the state in the Pahranagat Valley and along the Virgin River (Floyd et al. 2007). Due to marginal habitat occurring within the study area, the potential for this species to occur within the study area is considered low.

Western Burrowing Owl

The burrowing owl is known to breed throughout Nevada. The majority of the breeding population is known to migrate from northern Nevada to southern California and Mexico during the winter months. However, observations of this owl have been recorded in Nevada year-round (Floyd et al. 2007; Herron et al. 1985). Breeding is strongly dependent on the presence of burrows constructed by prairie dogs, ground squirrels, or badgers. Prime burrowing owl habitat must be open, have short vegetation, and contain an abundance of burrows. Burrowing owls begin nesting in April and young typically fledge by August (Floyd et al. 2007; Herron et al. 1985; Neel 1999). This species has been observed nesting in the vicinity of the study area along Boulder Creek (BLM 2008b; Great Basin Ecology 2009) and suitable nesting habitat occurs within the study area. Based on the presence of suitable nesting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Long-eared Owl

Long-eared owls occur within piñon-juniper woodlands, coniferous forests, and riparian areas at higher elevations. The majority of Nevada's population of long-eared owls is considered non-migratory, although individuals occurring outside of Nevada have been known to winter in Nevada. Long-eared owls begin nesting in February and young typically fledge by July (Floyd et al. 2007; Herron et al. 1985; Neel 1999). This species has been documented southwest of the study area in Boulder Valley (BLM 2008b). Suitable foraging habitat occurs within the study area. However, due to a lack of roosting and nesting habitat, the potential for this species to occur within the study area is considered low.

Short-eared Owl

Short-eared owls are year-round residents of Nevada, although few nest sites have been identified (Floyd et al. 2007; Herron et al. 1985). The species tend to nest in meadow and wetland habitats. Short-eared owls forage in open areas and are known to nest and roost on the ground. This species begins nesting in February and young typically fledge by July (Herron et al. 1985). Based on the presence of suitable nesting and foraging habitat occurs within the study area, the potential for this species to occur within the study area is considered high.

Lewis's Woodpecker

The Lewis's woodpecker breeds in isolated pockets in the northern half of Nevada. This species is found in open forest habitats such as ponderosa pine forests, burned-over Douglas fir forests, piñon-juniper woodlands, oak woodlands, and riparian areas. Nesting habitat consists of these habitats with a grassy or brushy understory (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Based on the lack of suitable foraging and breeding habitat within the study area, the potential for this species to occur within the study area is considered low.

Pinyon Jay

The pinyon jay occurs throughout the western United States and is a permanent resident of Nevada. This species is strongly associated with piñon-juniper forest habitats and can be found along the piñon-juniper belt extending from the Humboldt River south to the Mojave Desert. Pinyon jays are semi colonial nesters and occur in large groups where food is abundant (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Based on the lack of suitable foraging and breeding habitat within the study area, the potential for this species to occur within the study area is considered low.

Juniper Titmouse

The juniper titmouse is a year-round resident that is strongly associated with piñon-juniper woodlands. This species occurs along the piñon-juniper belt through Nevada, ranging from 4,500 to 7,500 feet in elevation. Dense foliage and closed canopies are preferred, while thin understory and ground cover are preferred for some feeding activities. This species often nests in cavities in riparian vegetation juxtaposed to piñon-juniper. As a result, the juniper titmouse tends to frequent the interface between piñon-juniper and riparian habitats (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Based on the lack of suitable foraging and breeding habitat within the study area, the potential for this species to occur within the study area is considered low.

Loggerhead Shrike

The loggerhead shrike is a common resident throughout Nevada. This species is found in open grasslands along valley floors and the foothills of the Great Basin. In Nevada, it is commonly found in scrub habitat types such as sagebrush and greasewood. Loggerhead shrikes prefer shrubs or small trees for nesting, but nesting also can occur in piñon-juniper woodlands. This species can be found perching on wire, fences, or poles (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Based on the presence of suitable nesting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

Yellow-breasted Chat

The yellow-breasted chat is found throughout Nevada, although it is more common in the eastern portion of the state. This species is found in cottonwood, willow, riparian, and other woodland habitats with dense understories (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Due to marginal habitat occurring within the study area, the potential for this species to occur within the study area is considered low.

Vesper Sparrow

The vesper sparrow is a summer resident that occurs in various open shrub habitats from high elevation valleys to higher mountain slopes and basins. This species occurs from approximately 5,500 feet in elevation in the foothills of northern Nevada to approximately 9,000 feet in elevation in surrounding mountain ranges. Open areas with a scattered canopy of big sagebrush and a minimum ground cover of 20 percent grasses, forbs, and young shrubs appear to be the preferred nesting habitat for this species. Nests are typically placed on the ground under or near shrubs (Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006). The breeding season for this species is April 15 to July 15. Based on the presence of suitable nesting and foraging habitat within the study area, the potential for this species to occur within the study area is considered high.

3.18.1.3 Amphibians

Columbia Spotted Frog

The Columbia spotted frog occurs primarily in central Nevada (Nye County) and northeast Nevada (Elko and Eureka counties), usually at elevations between 5,600 and 8,700 feet. This species prefers quiet aquatic habitats including perennial streams, ponds, springs, lakes, and marshes. The Columbia spotted frog may travel to uplands during wet weather, expanding localized populations. Females begin laying eggs in late April and May and tadpoles emerge by August (USFWS 2010b). Known populations of Columbia spotted frogs exist in the Independence Range approximately 15 miles east of the study area. This species has not been recorded within the study area; however, marginal habitat occurs within the study area in mapped wetlands (Cedar Creek Associates, Inc. [Cedar Creek] 2009) and along Boulder Creek. Based on the presence of marginal habitat within the study area, the potential for this species to occur within the study area is considered low.

Northern Leopard Frog

The northern leopard frog is broadly distributed in limited and isolated habitats from eastern Nevada to northern and western Nevada. Most Nevada populations are highly localized and isolated from one another (NatureServe 2010; Wildlife Action Plan Team 2006). This species inhabits permanent water with rooted aquatic vegetation such as springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes. In summer, it commonly inhabits wet meadows and fields and takes cover underwater, in damp niches, or in caves when inactive. Eggs are laid and larvae develop in shallow, still, permanent water (typically), generally in areas well exposed to sunlight. Eggs are typically attached to vegetation just below the surface of the water. Females begin laying eggs in late April and May and tadpoles emerge by August (NatureServe 2010; Wildlife Action Plan Team 2006). This species has not been recorded within the study area; however, marginal habitat occurs within the study area in mapped wetlands (Cedar Creek 2009) and along Boulder Creek. Based on the presence of marginal habitat, the potential for this species to occur within the study area is considered low.

3.18.2 Environmental Consequences

Primary issues related to special status species would include the loss or alteration of native habitats, increased habitat fragmentation, animal displacement, and direct loss of wildlife. Potential impacts for 35 status species identified as potentially occurring within the study area are discussed below.

3.18.2.1 Proposed Action

Surface Disturbance

The proposed project would result in the long-term reduction of approximately 2,505 acres of wildlife habitat, including approximately 1,960 acres of sagebrush shrubland, 543 acres of grassland, and approximately 2 acres of riparian areas and herbaceous wetland. Woody species such as sagebrush would require up to 25 years to reach maturity. The disturbance associated with the proposed project would be reclaimed following completion of mining activities with the exception of 278 acres associated with the open pit expansion.

Similar to impacts discussed in Section 3.17, Wildlife and Aquatic Biological Resources, impacts to special status species from mine-related surface disturbance would include the short-term (temporary) and long-term reduction or loss of habitat. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals, and the displacement of more mobile species into adjacent habitats. In areas where habitats are at, or near, carrying capacity, animal displacement could result in some unquantifiable reductions in local wildlife populations. Mine-related surface disturbance also would result in an incremental increase in habitat fragmentation at the mine site until vegetation has been re-established. It is anticipated that the potential mine-related displacement and habitat fragmentation impacts would be highest for special status species that may use the riparian corridors along Boulder Creek.

Mammals

Bats

Of the 13 bat species that could occur in the study area, eight (pallid bat, Townsend's big-eared bat, big brown bat, small-footed myotis, long-eared myotis, long-legged myotis, Yuma myotis, and western pipistrelle bat) have been documented within the project region (BLM 2008b; Bradley et al. 2006). Implementation of the proposed project could result in direct and indirect impacts to local bat species and their habitat. Direct impacts would include the long-term disturbance of foraging habitat, including approximately 1,960 acres of sagebrush shrublands, 543 acres of grassland habitat, and approximately 2 acres of herbaceous wetland from the development of the proposed project. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. However, due to the lack of roosting habitat within the study area, project construction would not result in population-level impacts to sensitive bat species.

Preble's Shrew

Implementation of the proposed project would result in the long-term reduction of approximately 2,505 acres of potentially suitable habitat for this species, until reclamation was completed and vegetation re-established. This impact would be considered negligible considering the large amount of suitable habitat located in the project region. Indirect impacts associated with mine-related noise and human presence currently occurs at the site and would increase under the proposed project. However, project construction could result in the direct mortalities of individual shrews, if present. The loss of individual Preble's shrews would not result in population-level impacts.

Fletcher Dark Kangaroo Mouse

Implementation of the proposed project would result in the long-term reduction of approximately 2,505 acres of potentially suitable habitat for this species, until reclamation was completed and vegetation re-established. This impact would be considered low, considering the large amount of suitable habitat located in the project region. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. However, project construction could result in the direct mortalities of individual mice, if present. The loss of individual Fletcher dark kangaroo mice would not result in population-level impacts.

Pygmy Rabbit

Implementation of the proposed project would result in the long-term reduction of approximately 1,960 acres of potentially suitable sagebrush habitat (big sagebrush-dominated habitats) for this species, until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. These impacts would be considered moderate, considering the extent of potentially suitable habitat (mature sagebrush) located in the project region. However, project construction could result in the direct mortalities of individual rabbits, if present. The loss of individual pygmy rabbits (a game species in Nevada) would not result in population-level impacts.

Birds

Based on implementation of applicant-committed environmental protection measures, no adverse impacts to sensitive raptors and migratory bird species have been identified in association with the construction and operation of the proposed project. Other potential species-specific impacts are discussed below.

Bald Eagle

No bald eagle nests occur within the study area. Occurrence by this species would be limited to migrating and dispersing individuals. Direct impacts would include the long-term reduction of approximately 2,505 acres of potential foraging habitat, until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on implementation of Barrick Dee Mining Venture (BDMV's) committed environmental protection measures, the lack of existing nest sites within the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Swainson's Hawk

No Swainson's hawk nests have been identified in the study area. In addition, no suitable nesting habitat occurs within the study area. Direct impacts would include the long-term reduction of approximately 2,505 acres of potential foraging habitat, until reclamation was completed and vegetation re-established. However, this impact would be considered negligible based on the overall availability of suitable foraging habitat in the vicinity of the study area. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on implementation of applicant-committed environmental protection measures, the lack of existing nest sites within the project vicinity, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Ferruginous Hawk

No ferruginous hawk nests have been identified in the study area. Direct impacts would include the long-term reduction of approximately 2,505 acres of potential foraging habitat, until reclamation was completed and vegetation was re-established. However, this impact would be considered negligible based on the overall availability of suitable foraging habitat in the vicinity of the study area. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on implementation of applicant-committed environmental protection measures, the lack of existing nest sites within the project vicinity, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Golden Eagle

No golden eagle nests have been identified within the study area. Direct impacts would include the long-term reduction of approximately 2,505 acres of potential foraging habitat, until reclamation was completed and vegetation was re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on implementation of applicant-committed environmental protection measures, the lack of active nest sites within the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Prairie Falcon

The nearest documented prairie falcon nest is approximately 7 miles north of the study area. Direct impacts to prairie falcons would include the long-term reduction of approximately 2,505 acres of potential foraging habitat, until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, the lack of active nest sites within the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Greater Sage-grouse

The nearest active lek site occurs approximately 3.5 miles north of the study area. As a result, no direct impacts to breeding greater sage-grouse (or leks) would be anticipated from the proposed project. Potential impacts are anticipated to occur as a result of disturbance to sagebrush habitat within the study area in association with the development of the proposed project. Potential direct impacts would include the incremental long-term reduction of approximately 2,505 acres of habitat that may potentially be utilized as nesting, early brood, late summer, and winter habitat. In addition, 808 acres of PPH-Important Habitat would be incrementally lost as a result of development of the proposed project. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the limited use of sagebrush habitat within the study area by this species, the distance of active leks from existing and proposed facilities, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Long-billed Curlew

This species has been documented within the study area and limited habitat occurs along Boulder Creek. Direct impacts to this species would result from the long-term reduction of approximately 543 acres of grassland habitat and approximately 2 acres of riparian areas and herbaceous wetland habitat. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, limited marginal habitat in the vicinity of the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Western Yellow-billed Cuckoo and Yellow-breasted Chat

These species have not been documented within the study area and limited marginal habitat (e.g., willows) occurs along portions of Boulder Creek. Direct impacts to this species would result from the long-term reduction of approximately 2 acres of riparian areas and herbaceous wetland habitat. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, limited marginal habitat in the vicinity of the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Western Burrowing Owl

NDOW documented burrowing owls during the spring of 2011 in Boulder Valley. Suitable nesting habitat also occurs within the study area. Direct impacts to this species would include the long-term reduction of approximately 2,505 acres of breeding and foraging habitat, until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on implementation of applicant-committed environmental protection measures, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Long-eared Owl

This species has not been documented breeding within the study area and breeding habitat is limited within the study area. Direct impacts to this species would result from the long-term reduction of approximately 2,505 acres of potential foraging habitat until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, limited breeding habitat in the vicinity of the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Short-eared Owl

This species has not been documented within the study area although suitable nesting habitat is present throughout the study area. Direct impacts to this species would result from the long-term reduction of approximately 2,505 acres of potential foraging habitat until reclamation was completed and vegetation re-established. These impacts would be considered negligible based on the overall availability of suitable habitat in the vicinity of the study area. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, the overall availability of suitable habitat in the vicinity of the project, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Lewis's Woodpecker, Pinyon Jay, Juniper Titmouse

Based on the presence of suitable habitat (e.g., piñon-juniper woodlands) in the study area, direct impacts to these species would result from the long-term reduction of approximately 1,960 acres of sagebrush shrubland habitat. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, the overall availability of suitable habitat in the vicinity of the project, and the existing level of activity at the mine site, potential impacts to these species as a result of the proposed project would be considered low.

Loggerhead Shrike, Vesper Sparrow

Based on the presence of potentially suitable breeding habitat, direct impacts to this species would include the long-term reduction of approximately 2,505 acres of potential breeding and foraging habitat, until reclamation was completed and vegetation re-established. Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under the proposed project. Based on the implementation of applicant-committed environmental protection measures, the overall availability of suitable habitat in the vicinity of the project, and the existing level of activity at the mine site, potential impacts to these species as a result of the proposed project would be considered low.

Amphibians

Columbia Spotted Frog, Northern Leopard Frog

The expansion of the pit would remove three wetlands designated as AR1, AR16, and AR17 in the project study area. Surveys were conducted in July 2010 in these three wetlands, as well as the sediment pond (AR09) (BLM 2010i). No amphibians were observed in any of these waterbodies. The absence of amphibians in these wetlands and pond indicates that potential habitat for the Columbia spotted frog and northern leopard frog is limited. In addition, no previous records exist for these species in the Boulder Creek drainage. Therefore, no impacts are expected for these species as a result of the proposed project.

Human Presence and Noise

Impacts to special status species would parallel those discussed in Section 3.17.2, Environmental Consequences.

Water Management Activities

Impacts to special status species would parallel those discussed in Section 3.17.2, Environmental Consequences.

Hazardous Materials Spill

Impacts to special status species would parallel those discussed in Section 3.17.2, Environmental Consequences.

3.18.2.2 Single Waste Rock Disposal Facility Alternative

Impacts to special status species would be the same as described for the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Over all this alternative would result in 128 fewer acres of wildlife habitat. This alternative would extend the disturbance footprint of the West WRDF approximately 0.25 mile farther north compared to the Proposed Action Alternative. All other direct and indirect impacts would be similar to the Proposed Action.

3.18.2.3 Partial Pit Backfill Alternative

Under the Partial Pit Backfill Alternative, impacts for Special Status Species would be the same as described for the Proposed Action, except that an additional 291 acres would be reclaimed in the open pit during final reclamation.

3.18.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and impacts to special status species would not occur. Under this alternative, approximately 2,505 acres of wildlife habitat would not be disturbed or lost, as described under the proposed project. Additional habitat fragmentation and animal displacement would not occur, limiting the impacts to wildlife resources to existing conditions. The level of human use would remain the same as the current levels. Completion of closure and reclamation activities associated with existing disturbance, and mineral exploration activities within the study area, would be conducted under existing authorizations.

New disturbance would not occur near Boulder Creek under the No Action Alternative. Therefore, potential sedimentation impacts on aquatic special status species (i.e., Columbia spotted frog and northern leopard frog) and their habitat would not result under the No Action Alternative. In addition, the loss of several wetlands containing aquatic habitat would not occur because the pit would not be expanded. A low level risk of fuel spills on aquatic habitat would exist for the No Action Alternative, although the Spill Prevention, Control, and Countermeasure Plan would be implemented to reduce spill risks.

3.18.3 Cumulative Impacts

The CESA for special status wildlife species is defined in Section 3.18.1, Affected Environment, and is shown in **Figure 3.18-1**; the CESA for greater sage-grouse is presented in **Figures 3.18-2** and **3.18-3**. The CESA for special status aquatic species is defined in Section 3.18.1, Affected Environment, and is shown in **Figure 3.18-4**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.18.3.1 Proposed Action

Table 3.18-1 presents the disturbance of greater sage-grouse habitat by wildfires (1980 to 2011) and mining operations. Past, present, and RFFAs from utility and energy development (Ruby Pipeline, North Elko Pipeline, TS Power Plant, and Tuscarora Geothermal Power Plant) have resulted, or would result, in up to 3,210 acres of additional disturbance. The CESA for greater sage-grouse encompasses areas that are utilized by greater sage-grouse in relation to past, present, and RFFAs. Several thousand acres of cultivated alfalfa in Boulder Valley and the Humboldt River Valley (area north of Battle Mountain) may potentially provide late summer/brood-rearing habitat for greater sage-grouse (BLM 2008b). These areas provide succulent forbs sought by greater sage-grouse, which include alfalfa and other annual or perennial forbs. The current extent of potential use of these cultivated areas by greater sage-grouse is unknown since cover provided by sagebrush habitats adjacent to these fields has been impacted by wildfires in many areas over the last 20 to 30 years (BLM 2008b).

Table 3.18-1 Cumulative Special Status Species Habitat Disturbance

CESA	Habitat Classification	Total Acres of Habitat	Acres of Habitat Disturbed by Fire	Acres Disturbed by the Proposed Action	Acres of Habitat Disturbed by Mining Operations (Past, Present, and RFFAs[1])	Acres of Habitat Disturbed by Utility and Energy Development (Past, Present, and RFFAs)	Percent of Total Habitat Acres Disturbed
Special Status Species[2]	NA	2,389,947	1,131,690 (47%)	2,505 (<1%)	38,622 (2%)	3,210 (<1%)	1,172,817 (49%)
Greater Sage-grouse (habitat type)[3]	NA	2,272,791	1,051,007 (46%)	2,505 (<1%)	37,142 (2%)	3,210 (<1%)	1,093,864 (48%)
Greater Sage-grouse (habitat classification)[4]	PPH - important	492,240	257,541 (52%)	808 (<1%)	122 (<1%)	223 (<1%)	258,694 (53%)

[1] See **Table 3.1-1** for breakdown of mining projects.

[2] The special status CESA is identical to the wildlife CESA, excluding greater sage-grouse.

[3] Includes NDOW designated nesting, early brood, late summer, and winter habitat.

[4] PPH and PGH are as described in BLM Instruction Memorandum 2012-043.

Sources: BLM 2012; NDOW 2012, 2010a; U.S. Geological Survey 2004.

Studies have shown that development can negatively impact greater sage-grouse populations as a result of habitat loss and increased human disturbance (Holloran 2005; Walker et al. 2007). Greater sage-grouse have been observed to abandon lek sites in areas with increased road development (Braun 1986; Holloran 2005; Walker et al. 2007). Compared to hens in undisturbed leks, greater sage-grouse hens that used breeding leks within approximately 2 miles from the development area moved further away from breeding leks to nesting areas and had lower nest initiation rates (Lyon and Anderson 2003). Furthermore, greater sage-grouse hens that utilized habitats farthest from roads had greater brood survivorship than those hens utilizing habitat near roads (Lyon and Anderson 2003).

Connelly et al. (2000) recommend that facilities be located more than 2 miles from active lek sites under ideal habitat conditions, 3 miles when habitat conditions are not ideal, and 11 miles when greater sage-grouse populations are migratory. It is assumed that habitat conditions within the study area are not ideal, based on fire history and the current level of human disturbance and noise levels from the large amount of mining activity along the Carlin Trend. In addition, the loss of wetland habitat within the study area would contribute to the cumulative loss of available surface water and wetland habitat within the greater sage-grouse CESA. Combined with mine groundwater pumping activities from other mining projects, within the greater sage-grouse CESA, loss of wetland habitat or reduced flows in springs and seeps, may impact important brooding habitat for greater sage-grouse and other special status species (BLM 2010b). Loss of wetlands and reductions or elimination of flows in springs and seeps could impact greater sage-grouse dependent on these sites and may impact the distribution and use of habitat during the spring, summer, and early fall.

Potential cumulative impacts to other special status species would parallel those described in Section 3.17.3, Cumulative Impacts.

3.18.3.2 Single Waste Rock Disposal Facility Alternative

Cumulative effects under the single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action, except that 154 fewer acres of habitat disturbance would occur under this alternative. Implementation of this alternative also would result in a reduction of 154 acres of potential nesting and seasonal sage grouse habitat in the CESA.

3.18.3.3 Partial Pit Backfill Alternative

Cumulative effects under the Partial Pit Backfill Alternative to Special Status Species would be the same as discussed under the Proposed Action, except that an additional 291 acres would be reclaimed in the open pit during final reclamation.

3.18.3.4 No Action Alternative

Cumulative impacts to special status species for the No Action Alternative generally would be the same as described for the proposed project, except that there would be 2,505 fewer acres of habitat disturbance and reduced habitat fragmentation within the CESA.

Under the No Action Alternative conditions, potential sediment and fuel spill risks would continue to exist within the CESA. However, existing sediment-control and spill plans would be used to minimize impacts on the Boulder Creek drainage. These low level impacts would combine with other surface disturbance activities within the CESA.

3.18.4 Potential Monitoring and Mitigation Measures

The following mitigation measure is recommended for greater sage-grouse.

Issue: The proposed project would remove or disturb important greater sage-grouse habitat (PPH). Important greater sage-grouse habitat in the Carlin Trend has been modified by large wildland fires that have converted sagebrush communities to a cheatgrass landscape, and by past and present mining operations. The implementation of the proposed project would further reduce important habitat for greater sage-grouse in the Carlin Trend.

Mitigation Measure SS-1: In order to reduce project-related impacts that would remove or disturb approximately 808 acres of important greater sage-grouse habitat, Barrick Dee Mining Venture (BDMV) would restore important greater sage-grouse habitat located on Bureau of Land Management (BLM) land immediately north of the proposed project area at a ratio of 2:1, approximately 1,616 acres. The locations of possible restoration areas are shown in **Figure 3.18-7**. Restoration activities that would be used to restore important greater sage-grouse habitat include, but are not limited to:

Seeding Treatments – Possible seeding treatments include broadcast and drag, drill, broadcast/aerial, harrow, disking, and hand.

Mechanical Treatment – To provide for an adequate seedbed, mechanical treatments would include disking (plowing), harrowing and mowing of existing grasses.

Livestock Grazing and Protective Fencing – Rest from livestock grazing.

Herbicide Treatment – A combination of Imazapic and Glyphosate herbicide treatments would be used to suppress non-native annuals and crested wheatgrass in order to introduce shrubs, forbs and grasses into the treatment areas.

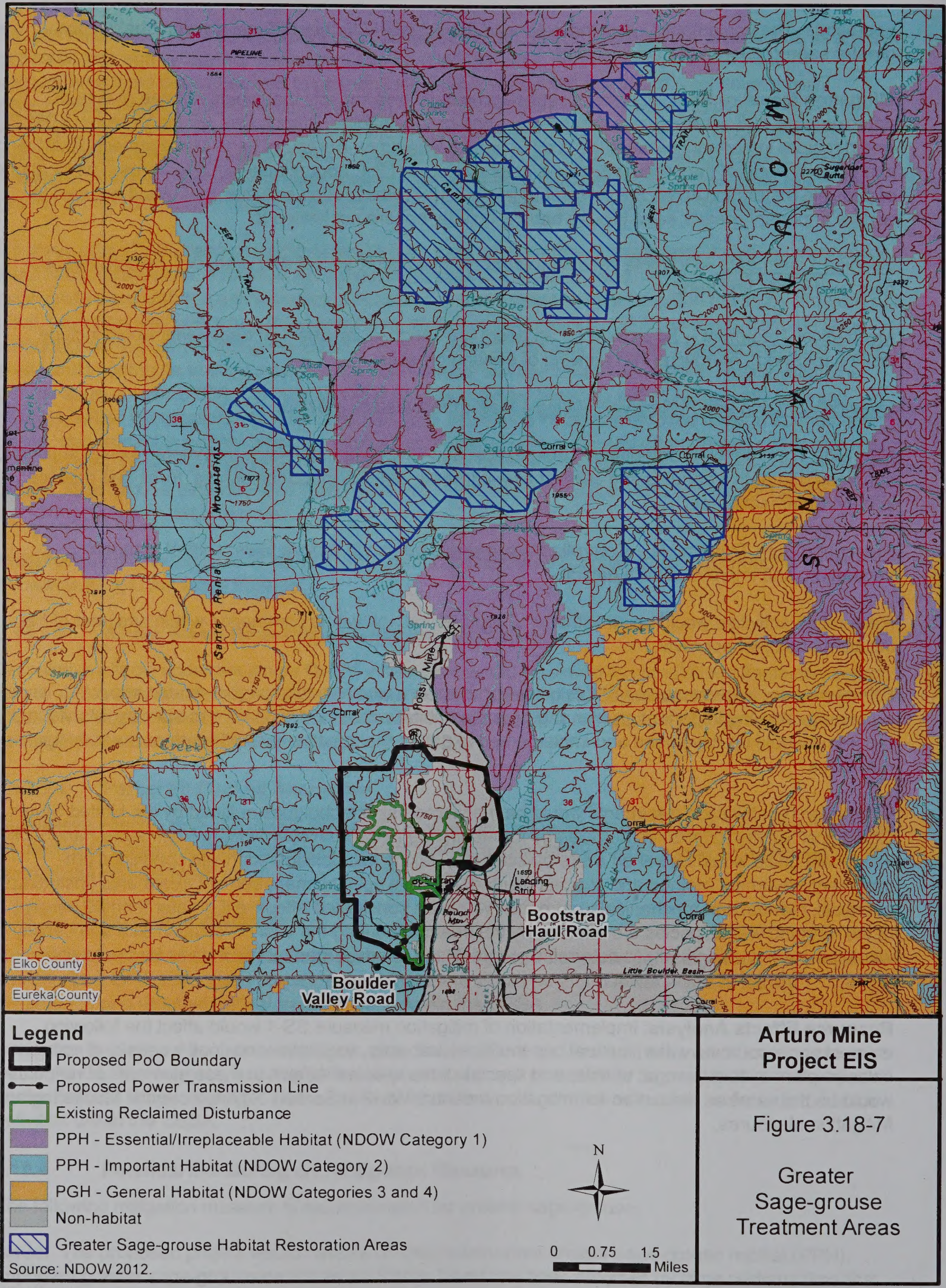
Prescribed Burn Treatments – Controlled burns would be use to reduce fuels, control competing vegetation, and improve wildlife habitat.

Restoration activities would occur within a 10-year period and would commence within one year of the initiation of project approval.

Effectiveness: Implementation of this mitigation measure would reduce project-related impacts to sage-grouse by restoring important greater sage-grouse habitat within the CESA for this species. Monitoring programs would be developed and implemented to gauge the effectiveness of treatments and mitigation measures.

Vegetation rehabilitation treatments would be monitored using techniques outlined by the United States Geological Survey (USGS) in the *Strategy for Monitoring Post-fire Rehabilitation Treatments Handbook*. Treatment goals would be set on a site-by-site basis, taking into consideration site conditions pre-treatment, treatment method and species planted. Invasive species management treatments (including chemical, manual and mechanical treatments) would be considered effective if greater than 80 percent of the targeted weed species are affected by the treatment during the year. Infestation size and density would be measured annually to determine progress and to adapt management plans for treatment areas.

Resource Effects Analysis: Implementation of mitigation measure SS-1 would affect the following elements or resources: water, cultural, air quality, visual, soils, vegetation, noxious weeds and non-native invasive plant species, range, wildlife, and special status species. Affects to these elements or resources would be the same as discussed for mitigation measure WL-2 in Section 3.17.4, Potential Monitoring and Mitigation Measures.



Source: NDOW 2012.

Arturo Mine Project EIS

Figure 3.18-7

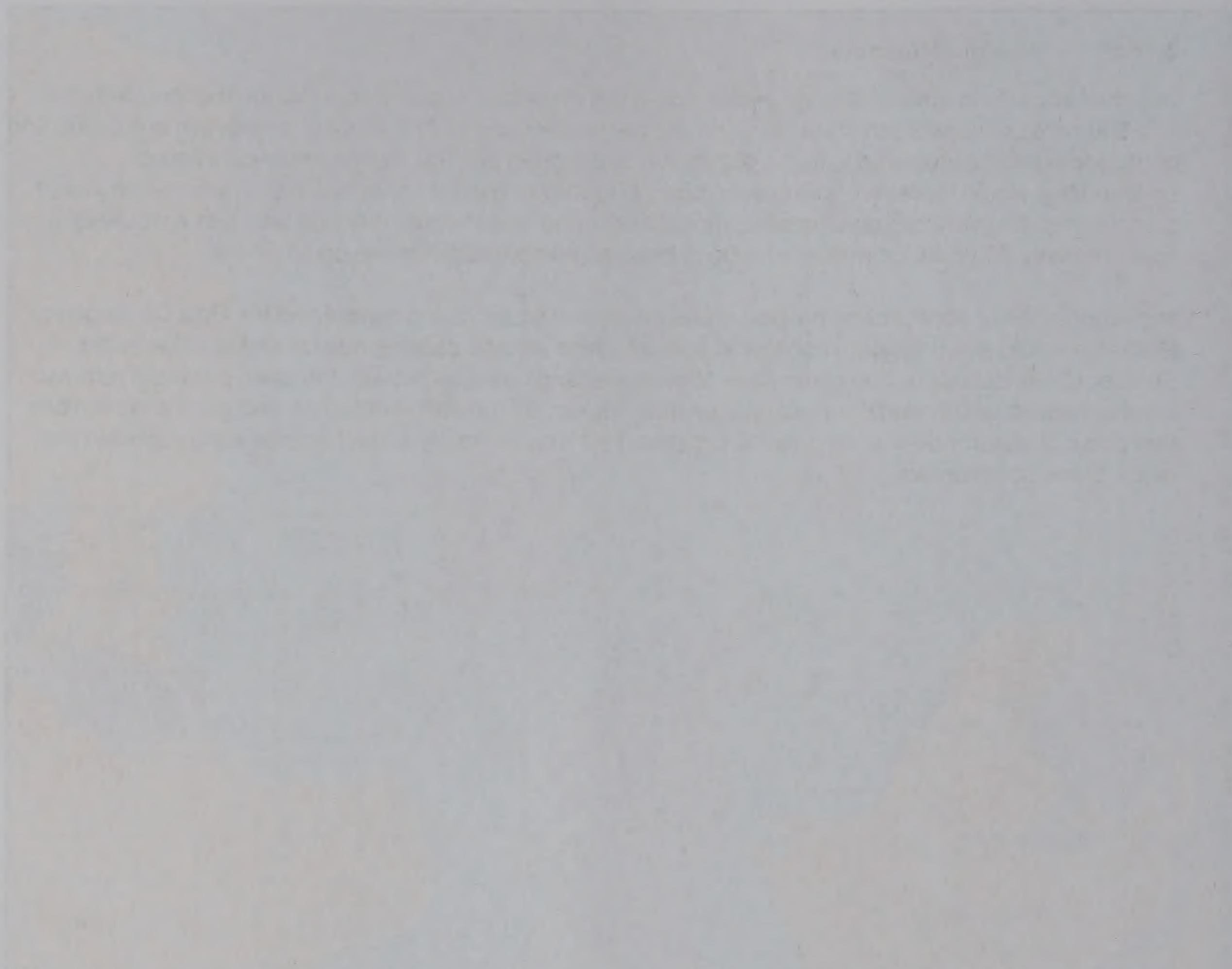
Greater Sage-grouse Treatment Areas

05/24/2012

3.18.5 Residual Impacts

Residual impacts to special status species under the Proposed Action would include the long-term loss of 1,960 acres of sagebrush shrubland and the permanent loss of 278 acres of sagebrush shrubland and grassland habitat associated with the expansion of the open pit. The loss of shrub-dominated communities would represent a long-term change in wildlife habitat composition (i.e., shrub-dominated communities to grass/forb dominated communities) under the Proposed Action because it would take approximately 25 years for mature shrubs to become established in these communities.

Implementation of applicant-committed measures involving sediment control and the Spill Contingency Plan also would avoid residual impacts to special status aquatic species habitat and species in the Boulder Creek drainage. The elimination of three wetlands associated with the open pit would remove aquatic habitat, which would represent a residual impact on macroinvertebrates and plant communities that occur in waterbodies when water is present. This may indirectly impact special status species that utilize these communities.



Arturo Mine Project EIS

Figure 3.18-[illegible]

Greater Sage-grouse Treatment Areas

3.19 Land Use and Access

3.19.1 Affected Environment

The study area for land use includes the proposed Plan of Operations (PoO) boundary; the Bootstrap Haul Road, power connection yard, secondary access road entrance, and power transmission line corridor that occur outside of the proposed PoO boundary; and an area within approximately 2 miles of the proposed disturbance area. The study area for access includes the proposed PoO boundary; the Bootstrap Haul Road, electrical substation area, secondary access road entrance, and power transmission line corridor that occur outside of the proposed PoO boundary; and the primary access roads approaching the project area including the transportation corridor for hauling ore to the mill site. The Cumulative Effects Study Area (CESA) for both land use and access is the same as the study area (**Figure 3.19-1**).

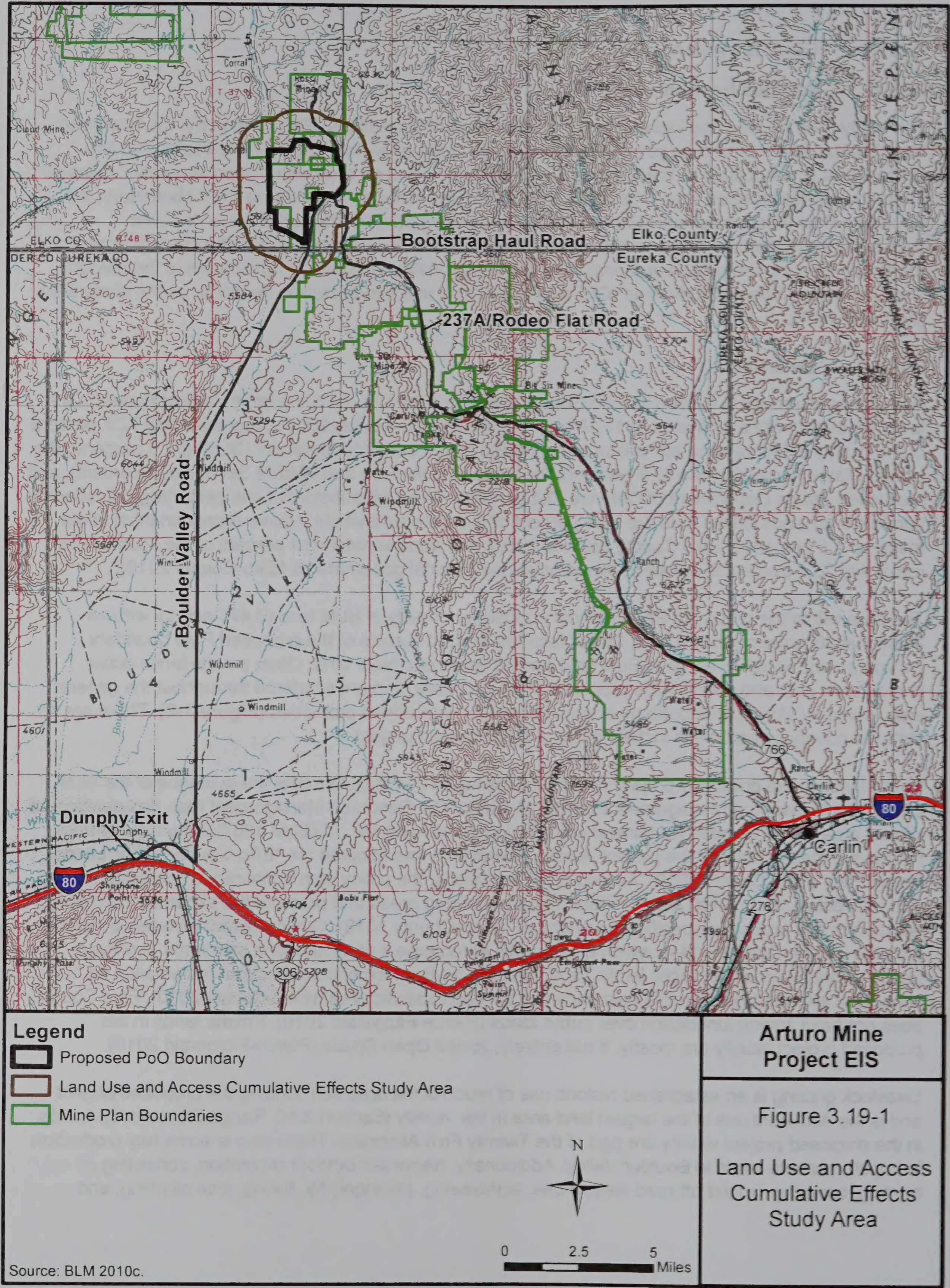
3.19.1.1 Land Use

The proposed project is located in Elko County, Nevada. Elko County is the fourth largest county in the lower 48 states with a land area of 17,181 square miles (Elko County 2010). Approximately 72.7 percent of the county is federal land administered by the Bureau of Land Management (BLM) (62.6 percent), the United States Forest Service (9.8 percent), the United States Fish and Wildlife Service (0.2 percent), and the United States Department of Defense (0.1 percent). Although substantial, the percentage of federally administered lands is less than the 86.5 percent of the state as a whole. Native American tribal lands make up 1.5 percent of Elko County and the state owns approximately 0.1 percent of the county. The remaining 25.7 percent is privately owned or owned by local governments (Elko County 2010).

The area within the proposed PoO boundary consists primarily of BLM land (3,475 acres), with an additional 38 acres of private land. Linear facilities located outside of the proposed PoO boundary include an additional 76 acres of BLM land and 38 acres of private land. Other private lands occur immediately east and south of the proposed PoO boundary, and are scattered throughout the general area, primarily along creek bottoms or on patented mining-related properties (**Figure 1-2**). There are no state- or county-owned lands in the vicinity of the proposed project.

Public lands in the proposed project vicinity are managed by the BLM under the guidance of the BLM Elko District Resource Management Plan (BLM 1986). The Resource Management Plan has designated project area lands "… open for mineral entry for locatable minerals …" (BLM 1987). Elko County does not have a master plan for the project vicinity. However, it has adopted the "Elko County Public Lands Policy Plan" (Elko County 2010). Among other provisions, the policy plan encourages continued mining under Directive 14-1, which states, "Retain existing mining areas and promote the expansion of mining operations and areas not specifically withdrawn" (Elko County 2010). Other relevant minerals policies in the plan include Directive 14-4, which encourages enforcement of reclamation standards to prevent "… undue degradation of the public lands," and Directive 14-6, which encourages that reclamation be "… consistent with the best possible post mine use for each specific area" (Elko County 2010). Elko County does not have zoning jurisdiction over public lands (Pierce-Fitzgerald 2010). Private lands in the proposed project vicinity are mostly, if not entirely, zoned Open Space (Pierce-Fitzgerald 2010).

Livestock grazing is an established historic use of much of the area surrounding the proposed project and is the dominant use of the largest land area in the vicinity (Section 3.16, Range Resources). Lands in the proposed project vicinity are part of the Twenty Five Allotment. There also is some hay production in irrigated private lands in Boulder Valley. Additionally, dispersed outdoor recreation, consisting of hunting, camping, limited off-road vehicle use, sightseeing, photography, hiking, rock climbing, and



Arturo Mine Project EIS

Figure 3.19-1

Land Use and Access Cumulative Effects Study Area

Source: BLM 2010c.

05/17/2012

visiting old mining camps, occurs on a seasonal basis, although not by large numbers of people. There are no developed recreation areas near the proposed project (Section 3.11, Recreation and Wilderness). There are no Indian Reservations in the vicinity of the proposed project. There are a limited number of land use authorizations and rights-of-way (ROWs) on BLM lands in the vicinity of the proposed project. **Table 3.19-1** provides specific information on the authorizations and ROWs based on BLM Master Title Plats and the LR2000 system (BLM 2010g). The road ROW authorization refers to the Bootstrap Haul Road. The power transmission line ROWs host the existing lines that provide power to existing mines southeast of the proposed project, such as the BGMI facility and the North Operations Area of the Carlin Trend. Under the Proposed Action, the existing 69-kilovolt (kV) power transmission line (ROW NVN 038874) would be upgraded to 120-kV to provide power for the proposed project.

Table 3.19-1 Land Use Authorizations and ROWs in the Study Area[1]

Serial Number	Grantee	Use	Township	Range	Section	ROW Width (feet)
NVN 007683	Newont Mining Corp.	Roads (Bootstrap Haul Road)	36N	49E	14	180
NVN 038874	Sierra Pacific Power Co.	Power transmission line	36N	49E	4	25
NVN 053160	Sierra Pacific Power Co.	Power transmission line	36N	49E	9, 14, 15	90
NVN 047775	Sierra Pacific Power Co.	Power transmission line	37N	49E	26	90

Serial Number	Grantee	Use	Township	Range	Section	Authorization Size (acres)
NVN 058227	Newmont Gold Co.	Patent Issued	36N	49E	10, 11, 14, 15	124.0
NVN 063106	Barrick Goldstrike Mines Inc. (BGMI)	Geothermal Lease	36N	49E	14, 15	725.1

[1] Not including mining-related surface operations authorizations.

Source: BLM 2010g.

3.19.1.2 Access

The proposed project would be accessed by a sparse network of roadways typical of rural Nevada. Interstate 80 (I-80) is the primary east-west traffic artery across northern Nevada, connecting Winnemucca, Battle Mountain, and Elko with Reno to the west, and Salt Lake City, Utah, to the east. The proposed area is located approximately 28 road miles north of Dunphy and I-80.

Primary access to the proposed project for employees and vendors would be from the Town of Carlin via State Road (SR) 766 and Rodeo Flat Road (County Road 237a), through the BGMI property, and along the Bootstrap Haul Road for a total of approximately 30 road miles to the proposed PoO boundary. The project also could be accessed by traveling 27 miles west of Carlin on I-80 to the Dunphy Exit, then 28 miles north on the Boulder Valley Road (a county-improved gravel road) to the existing entrance of the Dee Gold Mine. Some vendors would utilize the Boulder Valley Road to access the Arturo Project.

According to the proposed PoO, the portion of the ore that would be processed off-site would be trucked to the BGMI facility via the Bootstrap Haul Road. The haul road is a gravel surface private road, closed to public access.

According to the Nevada Department of Transportation (NDOT), only I-80 and SR 766 are included in the Nevada Federal Aid Highway System. The NDOT classifies I-80 as an Interstate Highway, and SR 766 as a Rural Major Collector (NDOT 2009).

Traffic is considered to be relatively light compared to road capacity on all proposed project access roads. Traffic on the gravel-surfaced county roads is primarily associated with mining and ranching, and is occasionally increased by dispersed recreation-related traffic. Vehicle use of the Boulder Valley Road 1.3 miles north of I-80 averaged 160 vehicles per day (vpd) in 2009. Existing traffic conditions on all paved highways are at level of service “A.” Vehicle use along I-80 averaged 11,000 vpd east of Carlin and 6,800 vpd near the Dunphy exit, both of which are well below its capacity. SR 766, 5 miles north of I-80, carried an average of 2,200 vpd in 2009, down from 2,650 vpd in 2006 (all count data were obtained from NDOT [2009]). Traffic counts on area roads generally peaked in 2006 or 2007; 2009 counts tended to be up slightly from 2008.

3.19.2 Environmental Consequences

Primary issues include potential conflicts with existing land uses, ROWs and other land use authorizations; potential impacts to two alternative access routes; and conflicts with land use plans or regulations for both public and private lands.

3.19.2.1 Proposed Action

The proposed project or alternatives could affect land use and access both directly and indirectly. Direct impacts may include the termination or modification of existing land uses or ROWs in the project area. Indirect impacts may result in altered land use patterns to other use areas adjacent to or near the project area. Indirect impacts also would occur if the proposed project or alternatives stimulated or encouraged the development of land uses not presently anticipated, or conversely, precluded other planned or proposed uses.

Land Use

The proposed project encompasses a total of approximately 3,627 acres, of which 3,551 acres (98 percent) are public lands administered by the BLM and approximately 76 acres (2 percent) are private lands. Proposed project activities on private lands include approximately 0.9 mile of rerouted power transmission line corridor, the construction of a new power connection yard, and approximately 106 acres devoted to widening the existing Bootstrap Haul Road, some of which is outside the proposed PoO boundary. As currently planned, total surface disturbance would be approximately 2,774 acres, 2,703 acres of which would be on public land. The proposed project would add approximately 1,962 acres to the existing and reclaimed disturbance of 812 acres – an increase of approximately 240 percent (**Table 2-2**).

Current use of land within the proposed project boundary is a mixture of mining (the Storm Underground Project) and grazing by both domestic animals and wildlife. There also may be a small amount of low density, dispersed recreation activity. As previously noted, there is cattle and horse grazing in the project vicinity under the permit stipulations of the Twenty Five Allotment. Recreation use is likely limited to occasional hunting and, possibly sightseeing by travelers on the Boulder Valley Road, which provides easy access to the area. None of these uses is believed to bring large numbers of the public into the project vicinity.

Approximately 30 percent of the proposed disturbance would occur on land that has been previously disturbed, of which approximately 67 percent was reclaimed subsequent to the prior mining activities

(**Table 2-2**). New project-related disturbance including a new fenced area around the proposed PoO boundary (approximately 3,513 acres) would reduce the amount of land available for livestock grazing and dispersed recreation, although the loss would be small relative to the total public land available for such activities in the project vicinity. The specifics of the loss of access to public lands are addressed in Section 3.16, Range Resources, and Section 3.11, Recreation and Wilderness. Approximately 3,333 acres would not be available for livestock grazing in the Twenty Five Allotment and 24 acres would not be available for livestock grazing in the T Lazy S Allotment until reclamation has been completed and vegetation re-established. Approximately 472 acres, in addition to the 129 acres of existing open pit disturbance, would be lost in the Twenty Five Allotment from the expansion of the open pit. None of the proposed surface disturbance would occur on currently irrigated cropland so there would be no loss of hay production from the proposed project.

The proposed project would not conflict with the few existing ROWs in the project vicinity. New ROW authorizations would be required to upgrade the existing 69-kV power transmission line to a 120-kV power transmission line. The proposed changes to the existing power transmission line would not adversely affect land use or power availability in the area.

Post-reclamation land use of most of the disturbance area would be returned to open space, grazing, dispersed recreation, and wildlife habitat. These uses would be consistent with local and BLM land use plans and guidelines. The proposed mine pit would not be reclaimed and would constitute the main area that would not be returned to prior use after closure and reclamation of the proposed project.

Access

Four categories of traffic would be generated on public roadways by the proposed project including construction traffic, worker commuting traffic, general company and contractor traffic, and material deliveries. Construction traffic would likely be a combination of medium- and heavy-duty trucks for delivery of equipment and materials. Mine workers would mostly commute in company contracted buses. General Barrick Dee Mining Venture (BDMV) and contractor traffic would be predominantly light vehicles, automobiles and pickup trucks. There also would be ore hauling by 320-ton trucks on the Bootstrap Haul Road.

Construction would involve 100 BDMV and contractor workers for approximately 8 months. Traffic could include two to three buses or up to 60 personal and company-owned automobiles and pickup trucks in the morning and evening. Most, if not all, of this traffic would access the project site using the Bootstrap Haul Road via SR 766 and Rodeo Flat Road (County Road 237a). Effects on transportation would be minor and short-term.

Worker commuter traffic would primarily consist of buses operating at shift change times plus a small number of personal vehicles. With a planned 24-hour, 7-day work schedule, it is assumed that fewer than half the 379 person maximum work force would be entering or exiting the site at any one time. This level of commuting could be accommodated by five or fewer buses bringing the incoming workers to the site and carrying departing workers back out. This would generate up to 10 vehicle trips in any 1-hour period, which would travel on SR 766 and Rodeo Flat Road. It is anticipated that this level of traffic would have very little, if any, effect on traffic flows or safety under the proposed project.

Heavy traffic from material deliveries to the proposed project area would consist of occasional tractor-trailer or straight truck deliveries at variable times throughout the day. It is expected that the traffic generation from this type of traffic would rarely, if ever, exceed 15 truckloads per day, or 30 vehicle trips, half in-bound and half out-bound. This type of traffic would likely happen over the course of the day and would add only a maximum of four to six vehicle trips during any given hour, such as a peak commuter shift change hour. At this level, considering the low levels of traffic on SR 766 and Rodeo Flat Road currently, the good condition of the road, and the generally long sight distances along most of the route, it is expected that the effects of the proposed project on traffic flow and safety along the roadway would be minor.

Transportation safety concerns related to traffic generated by the proposed project would be minimal. Lines of sight at intersections are unobstructed and sight distances are ample. Haul trucks would be segregated from light vehicles by a safety berm along the Bootstrap Haul Road (**Figure 2-9**). Development of the proposed project would have no effect on the physical characteristics of the major intersections or the geometrics of roadways. The increase in traffic would be modest, remaining well within the capacity of the roadways. The occurrence of heavy vehicles in the traffic stream would increase slightly, but not substantively. As such, any increase in the risk of traffic accidents would be minor and proportional to the overall increase in traffic. The combination of heavy and light vehicles would occur mostly on the mine sites or in mining areas, which are closed to the public.

Development of the proposed project would not significantly affect highway traffic in the project region. In summary, the effects of the proposed project on land use and access in the project area would be considered minor.

3.19.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of habitat disturbance. With the exception of a 4.6 percent reduction in land disturbance from this alternative, all other direct and indirect impacts associated with this alternative would be the same as the Proposed Action.

3.19.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would have a similar footprint as the Proposed Action. Design height and capacity of the West and East WRDF would be different compared to the Proposed Action. The West WRDF would be 230 feet lower and the East WRDF would be 310 feet higher under this alternative, and the number of pit lakes would be reduced from three to one. Mining would be sequenced differently from the Proposed Acton to allow backfilling portions of the open pit with waste rock during operation. Under this alternative, delays in the schedule to accommodate the backfilling would occur to adjust for transport of waste rock to the East and South Pits. The mining rate would slow by an estimated 22 percent, resulting in a 1-year extension of the mine life.

Land Use

There would be no notable differences in the effects on land use during the life of the mine as the distinguishing differences from the Proposed Action would occur within the same fenced perimeter. There would be approximately a 1-year delay in completing reclamation and returning the reclaimed areas to post-reclamation land use. This would be a minor effect in the context of the life of the Arturo Mine Project and the long-term availability of the area after project completion.

Access

Effects on access would be similar to those from the Proposed Action with the exception that there would be 90 fewer workers employed at the project during peak years. Most workers are expected to commute to the project site by bus so this alternative would result in approximately one fewer buses traveling to and from the mine during peak hours. This would be a very minimal reduction in traffic as compared with the Proposed Action.

3.19.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to access and land use would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, ongoing mineral exploration activities, and reclamation within the study area, would be conducted under existing authorizations. No additional ground-disturbing activities beyond those currently authorized would occur at the mine site.

Land Use

Effects of the existing activities at the Dee Gold Mine were addressed in prior environmental analyses. Under the No Action Alternative, previous approvals have resulted in 543 acres that have been previously disturbed and reclaimed and 269 acres that remain disturbed. This disturbance is ongoing and would continue. Some of the approved disturbance would be reclaimed when the Storm Underground Mine ceases operation in the future. These activities would have minimal, if any, effect on other land uses. The prior approval indicates conflicts with governmental regulations or policies would not be expected from the No Action Alternative.

Access

Most, if not all, of the traffic associated with the No Action Alternative currently occurs along Boulder Valley Road and the local road network. The traffic is being accommodated with no measurable adverse effect on the roads beyond regular maintenance, and all roads are well within their capacities to accommodate traffic. Public access to public lands is not restricted, except for access to the Storm Underground Mine, which is controlled by Barrick-Rossi Mine Venture. The effects of the No Action Alternative on land use and access in the project area would be minor.

3.19.3 Cumulative Impacts

The CESA for access and land use is defined in Section 3.19.1, Affected Environment, and is shown in **Figure 3.19-1**. Past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs for mining activities are identified in **Table 3.2-1** and their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.19.3.1 Proposed Action

Land Use

Past, present, and RFFAs within the land use and access CESA have resulted, or would result, in approximately 12,747 acres. Past, present, and RFFAs from utility and energy development (North Elko Pipeline) would result in up to 140 acres of additional disturbance. The proposed project incrementally would add 2,774 acres to the disturbance for a total of 15,661 acres of disturbance in the CESA. The proposed project would represent approximately a 22 percent increase over past, present, and RFFAs. The total cumulative disturbance, which is predominantly related to mineral development, would be consistent with Elko County and BLM plans, policies, and ordinances. The proposed project-related disturbance would be slightly over 3 square miles, which would be a small increment of the vast acreage of public lands in the region, and would have minimal effect on other existing or potential land uses in the CESA. The cumulative unreclaimed disturbance area that would remain after completion of the interrelated actions, including the pit areas of the proposed project, would be a small percentage of the total land area in the CESA, and would have a negligible effect on land uses.

The foreseeable improvements in range and habitat restoration would be expected to improve the economic viability of ranching in the CESA, partially offsetting the losses of grazing land from mineral development.

Access

Traffic generation data from the approved and reasonably foreseeable mineral development activities are unknown. However, most of these actions previously have been approved or are affiliated with existing mining operations. Consequently, it is assumed that most of the traffic that could be anticipated is currently on the road system. Based on this assumption and the substantial unused capacity on CESA roads and highways, it is expected that cumulative effects on traffic flow and safety would be minimal.

3.19.3.2 Single Waste Rock Disposal Facility Alternative

Land Use

Cumulative effects under the Single WRDF Alternative would be similar to cumulative effects associated with the Proposed Action, except that this alternative would reduce the cumulative land disturbance in the CESA by 128 acres, or approximately 1 percent. The reduction, while beneficial, would be negligible in the context of the total CESA.

Access

Traffic generation from the Single WRDF Alternative would be essentially the same as for the proposed project. Consequently, cumulative effects on traffic flow and safety from the Single WRDF Alternative would be the same as for the proposed project.

3.19.3.3 Partial Pit Backfill Alternative

Land Use

Cumulative effects under the Partial Pit Backfill Alternative would be similar to the cumulative effects associated with the Proposed Action, except that reclamation and return of the project area to post-mining land uses would be delayed by approximately 1 year for the Arturo Mine Project. This would be a very minor effect in the context of the entire CESA and the totality of past, present and RFFAs.

Access

Traffic generation from the Partial Pit Backfill Alternative would be slightly less than for the Proposed Action. Cumulative effects on traffic flow and safety from this alternative would be essentially the same as for the proposed project.

3.19.3.4 No Action Alternative

Most of the traffic that could be anticipated under the No Action Alternative is currently on the road system. Traffic from RFFAs would add small increments to the overall traffic load on area roads and highways, but there also would be minor reductions in traffic as existing mines reach the end of their productive lives. There is substantial unused capacity on CESA roads and highways so it is expected that cumulative effects on traffic flow and safety from the No Action Alternative would be minimal.

3.19.4 Potential Monitoring and Mitigation Measures

No additional monitoring or mitigation measures are recommended for land use or access.

3.19.5 Residual Impacts

Residual impacts to land use would include the permanent loss of 472 acres of vegetation in areas associated with the expansion of the open pit, which would not be reclaimed. Consequently, this area would not support grazing by cattle or terrestrial wildlife, or other surface uses common to the surrounding area. Three modest sized pit lakes would support water fowl, which may attract some recreational use, although safety barriers would discourage, if not completely prevent, access by the public. No residual impacts to roadways, traffic flows, or access to the rest of the project site would be expected.

3.20 Noise

The study area for noise effects encompasses an area within a 5-mile radius of the proposed Plan of Operations (PoO) boundary, and Bootstrap Haul Road, power connection yard, secondary road access entrance, and power transmission line corridor, that occurs outside of the proposed PoO boundary. The Cumulative Effects Study Area (CESA) includes an area within approximately 10 miles of the study area (**Figure 3.20-1**). The 5-mile direct noise effects study area is based on the estimation, derived from previous comparable projects, that mine noise would not exceed acceptable levels beyond that distance. The CESA is based on a doubling of the direct noise effects study area, assuming a comparable source, or sources, would have a similar direct effects radius.

3.20.1 Affected Environment

Describing the environment potentially affected by noise from the proposed project involves identifying noise-sensitive receptors and existing noise sources in the project vicinity, characterizing terrain features that may affect noise transmission, and determining existing noise levels.

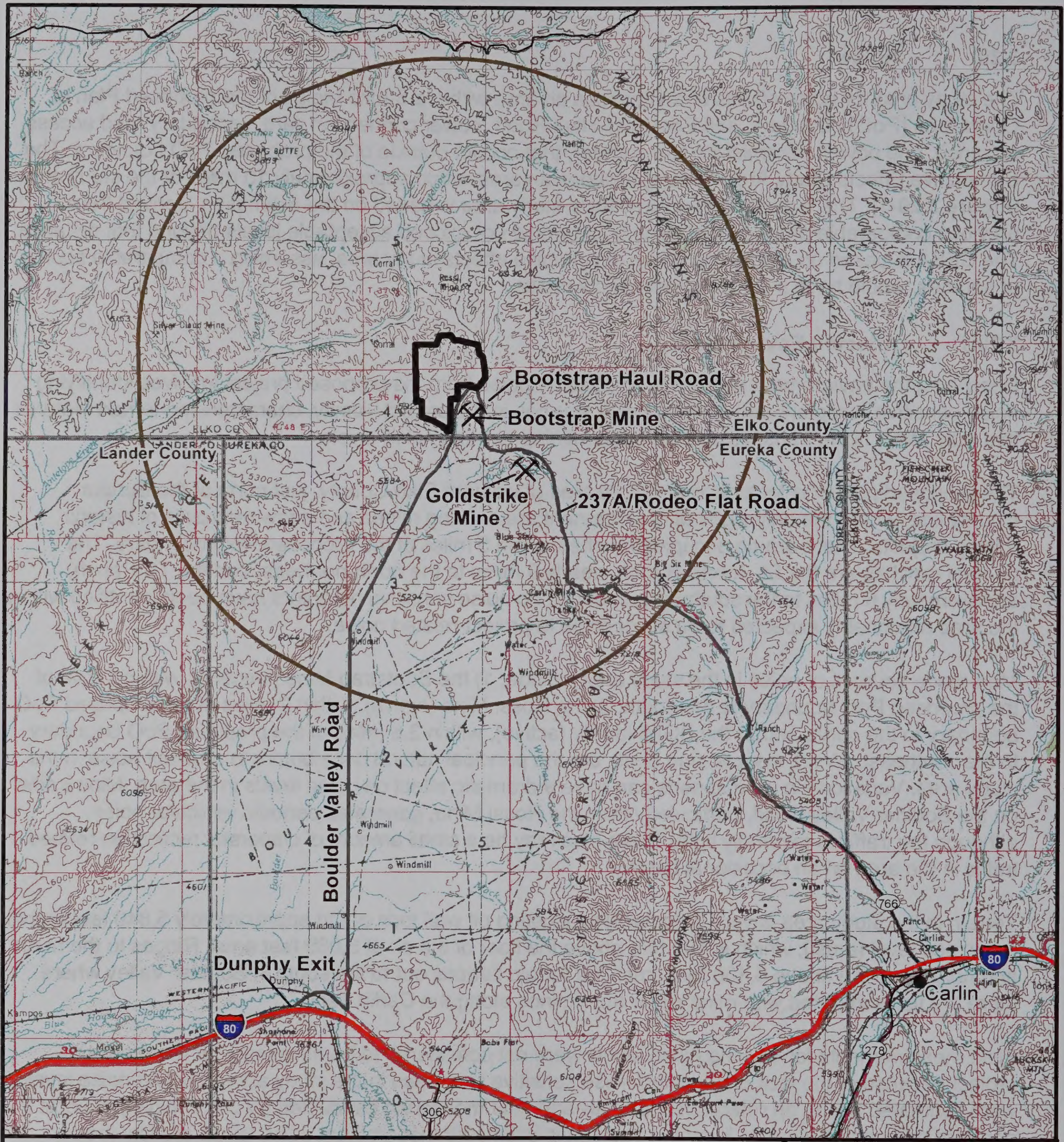
The proposed project is located in a remote area of western Elko County, just north of the Eureka County line, where the only signs of development are existing mines and a few remnants of historic mining projects. There are no occupied ranches within 5 miles of the proposed PoO boundary. The nearest ranches are the St. John's Ranch, nearly 9 miles to the north-northeast and the TS Ranch, approximately 6 miles to the southwest. In effect, no noise sensitive receptors have been identified within the area reasonably expected to be susceptible to project-related noise.

Man-made sources of noise in the study area include: 1) the Bootstrap Mine (inactive), within 1 mile of the proposed PoO boundary to the south, 2) the Rossi Mine (active), within 2 miles of the proposed PoO boundary to the north, and 3) the BGMI facility (active), within 3.5 miles of the proposed PoO boundary to the southeast. Wind, insects, and birds, are the principal natural contributors to ambient noise in the study area. Variations in wind speeds can have a dramatic effect on noise levels in the area. Mine traffic on the Boulder Valley Road, particularly from the Rossi Mine, generates periodic vehicular noise, although the traffic is generally light. There also may be a small amount of dispersed recreation-related traffic in the area on an occasional basis.

Terrain in the study area is very irregular. The existing pit wall tops out at approximately 5,840 feet above mean sea level (amsl), which is 780 feet above the floor of the pit at 5,060 feet amsl. Ridges to the north and northwest rise above 6,100 feet amsl; the terrain flattens out to the south in Boulder Valley where there are fields irrigated with mine water from mines along the Carlin trend.

Field measurements for existing noise levels were not considered to be necessary for the proposed project because of the lack of identified noise sensitive land uses in the study area. Existing noise levels were estimated based on reference materials and field monitoring conducted for other mining projects in northern and central Nevada in recent years. It is estimated that ambient noise levels are low (below 40 decibels on the A-weighted scale (dBA) at night and in the low to mid 40s dBA during the day in the absence of significant wind) in areas 1 mile or greater from active mining projects. Winds above 12 to 15 miles per hour would raise noise levels by 10 dBA, or more, with very strong winds adding even greater increases in ambient noise levels. At certain times of the year, insect activity also may increase noise levels, although generally by smaller increments than wind noise.

Noise levels within 0.25 to 0.5 mile of existing mining activities likely are somewhat higher. In general, noise levels near active mining vary with the particular activity and with proximity of the activity to the observer. Measurements at other mine sites suggest noise levels commonly range between 45 dBA and 55 dBA at project boundaries. These levels typically result from equipment moving waste rock or ore and from drilling equipment. Blasting is likely to be noticeable at distances of 1 mile or more, but it is typically



Legend

▭ Proposed PoO Boundary

▭ Cumulative Effects Study Area (Approximately 10 mile radius from Project)

Source: BLM 2010c.

Arturo Mine Project EIS

Figure 3.20-1

Noise Cumulative Effects Study Area

05/17/2012

a minor consideration since it generally occurs once per day at the same time every day, because modern blasting techniques employ a series of small charges rather than a single large charge, and because the duration of a blast sequence is very short, on the order of less than 5 seconds. Because of these characteristics, blasting has very little effect on day-night average sound levels (L_{dn}).

For comparison purposes, **Table 3.20-1** illustrates noise levels associated with several common indoor and outdoor activities, which would help to understand noise emission levels from the proposed project.

Table 3.20-1 Typical Values of Sound Level of Common Noise Sources

Sound Pressure Level (dBA)	Common Indoor Noise Levels	Common Outdoor Noise Levels
110	Rock band	--
105	--	Jet flyover at 1,000 feet
100	Inside New York subway train	--
95	--	Gas lawn mower at 3 feet
90	Food blender at 3 feet	--
85	--	Heavy truck at 50 feet
80	Garbage disposal at 3 feet, or shouting at 3 feet	Noisy urban daytime
70	Vacuum cleaner at 10 feet	Gas lawn mower at 100 feet
65	Normal speech at 3 feet	Commercial area, heavy traffic at 300 feet
60	Large business office	--
50	Dishwasher in next room	Quiet urban daytime
45	Small town residence	--
40	Small theater, large conference room	Quiet urban nighttime
35	Soft whisper at 6 feet	Quiet suburban nighttime
33	Library	--
28	Bedroom at night	--
25	Concert hall (background)	Quiet rural nighttime
15	Broadcast and recording studio	--
5	Threshold of hearing	--

Sources: Bureau of Land Management (BLM) 2000d; Harris 1979.

3.20.2 Environmental Consequences

Primary issues include the potential for project-related activities to increase noise levels to the degree that use and enjoyment of noise sensitive receptors would be affected. Noise impacts are commonly judged according to two general criteria: the extent to which a project would exceed federal, state, or local noise regulations, and the estimated degree of disturbance to people. There are no specific federal, state, or local noise regulations that would govern at the proposed Arturo Mine project. Neither the State of Nevada nor Elko County has noise regulations governing mining operations.

Without legislative guidance, the degree of disturbance becomes the key factor in evaluating noise effects. The concept of human disturbance is known to vary with a number of interrelated factors, including not only changes in noise levels, but the presence of other, non-project related noise sources in the project vicinity; peoples' attitudes toward the proposed project; the number of people exposed; and the type of human activity affected (e.g., sleep, quiet conversation or religious rituals as compared to physical work or active recreation).

In the absence of applicable noise regulations or specific standards, the noise analysis used 65 dBA (L_{dn}) as an absolute level criterion, and a 10 dBA increase above existing levels as a relative criterion, to evaluate projected project-related noise. L_{dn} is the average day sound level for a 24-hour, midnight to midnight period with 10 dBA added to the sound levels from 10:00 p.m. to 7:00 a.m. The 65 dBA L_{dn} criterion is based on the United States Housing and Urban Development noise guidelines, which identify levels in excess of 65 dBA L_{dn} as “normally unacceptable” for exterior noise for residential areas (U.S. Department of Housing and Urban Development 1996). A 10 dBA increase is perceived as a doubling of sound and is considered a likely indicator of community annoyance. The 10 dBA figure is based on United States Environmental Protection Agency (USEPA) studies showing that an increase of 10 dBA over existing background noise levels has commonly caused nearby residents to vigorously complain (USEPA 1974).

The study area has no residences or other gathering places, such as schools or churches, that are commonly identified as noise sensitive areas. Because of this, it was necessary to conduct the noise analysis to identify anticipated distances to the threshold standards rather than potential noise levels at sensitive receptors.

3.20.2.1 Proposed Action

Hard rock mining commonly generates noise from two primary sources: operations of both stationary and mobile heavy equipment, and blasting to loosen waste rock and ore from the bedrock for removal by truck and shovel operations. Major sources of noise from mining and processing operations of the proposed project would include rock drilling, blasting, loading of rock and ore, ore hauling, ore crushing, and crushed ore handling and distribution. Project construction also would include road building associated with the proposed haul road widening. An equipment roster with noise emissions estimates is illustrated in **Table 3.20-2**. Some additional equipment is in use at the Storm Underground Mine, but noise emissions from those sources are included in the existing estimated background noise levels. Noise emissions estimates for the various types of equipment were developed from published USEPA data (USEPA 1971), from the previous Nevada mining EISs (BLM 2002b, 1996a), and from file data for comparable mining projects in Nevada and other western states.

The proposed project would encompass an area of 3,627 acres, or approximately 5.7 square miles. The main noise generating activity centers would include the expanded pit, the West Waste Rock Disposal Facility (WRDF), the East WRDF, the new Heap Leach Pad No. 12, and mine traffic along the Bootstrap Haul Road.

For purposes of the analysis, assumptions were made regarding a roster of equipment that would be operating at each activity center at one time and total noise emission levels were calculated for the combined operations. Project-related noise levels are typically calculated at sensitive receptor locations; however, no sensitive receptors were identified in the study area. Consequently, the approach taken to analyze potential noise effects of the proposed project was to calculate the distance from the project to the two criteria noted above: an L_{dn} of 65 dBA, and a noise level of 10 dBA above existing ambient levels.

Table 3.20-2 Arturo Mine Project Equipment Roster

Equipment				Daily Operation		Comments
Type	hp*	Units	dBA[1,2]	Hours	Utilization (%)	
Rotary Drill	760	5	86	24	85	
Front End Loader (25-cubic-yard)	1,250	1	90	24	90	
Electric Shovel (70- to 115-ton payload)	NA	3	90	24	90	Electric only, no diesel
Mechanical Shovel (50-ton payload)	2,500	1	85	24	90	Diesel/Hydraulic
Haul Truck (320-ton)	2,700	30	90	24	90	
Motor Grader	265	4	85	24	85	
Track Bulldozer	580	4	87	24	80	
Wheel Bulldozer	800	4	85	24	90	
Blasting Truck	300	2	83	12	50	
Blasting Agent Loading Truck	400	3	83	12	90	
Backhoe Excavator	300	2	85	12	25	
Water Truck	1,350	4	83	24	85	
Hole Stemmer	40	3	85	12	50	
Maintenance Truck	250	3	83	24	50	
Welding Truck	250	2	83	24	50	
Tire Truck	300	1	83	24	85	
Service Truck	300	2	83	24	50	
Crane Flatbed	250	2	85	24	50	
Personnel Carrier	300	4	83	24	30	
Pickup Truck	250	10	75	24	30	
Pump	40	4	85	24	20	
Lighting Plant	27	10	78	24	50	
Other Temporary Support Equipment and Vehicles	200	20	70-85	24	25	

[1] Sound pressure levels measured at a reference distance of 50 feet.

[2] Sound pressure level per unit.

* Horsepower.

Sources: Barrick Dee Mining Venture 2010a; BLM 2007d.

The analysis was very conservative, as noise emission levels assumed all equipment at each activity center was operating simultaneously and sound pressure levels were not adjusted for utilization rates. In addition, noise attenuation was calculated only for the spreading of sound waves over distance; no adjustments were made for additional attenuation from atmospheric absorption, ground effects, or topographic barriers, which would come into play as work in the pit moved deeper below the ground surface level. This approach would ensure a maximum estimation of distance to the identified criteria perimeters. Under actual conditions, distances to criteria noise levels from the proposed project would be lower as a result of atmospheric absorption and ground absorption, and would decrease over time for barrier changes as pit depths increased and waste rock piles and heap leach pads grew.

Based on the equipment distribution scenarios developed for the project activity centers, and the assumptions described above, estimated project-related noise levels would drop to an L_{dn} of 65 dBA at a distance of 9,300 feet, or approximately 1.75 miles, from the activity centers. Project-related noise would drop below 10 dBA over background noise at a distance of just over 25,000 feet, or 4.75 miles, from mine related activity. (As noted above, background noise was assumed to be 40 dBA; therefore, 10 dBA above background noise would be 50 dBA.) These distances are believed to be worst-case, based on the conservative assumptions employed, and there are no identified noise-sensitive receptors within either of these perimeter distances.

Blasting noise is not included in the noise level estimates noted above, mainly because mine blasting is typically an extremely brief event occurring an average of once per day, depending on the operations plan for the pit. With this very brief and consistent type of noise emission, neither of the criteria noted for other mine-related noise is relevant to blasting noise. Although blasts are sometimes perceived by the layman to be a single explosion, mining blasts are actually a series of smaller, single-hole explosions. Each hole is sequentially delayed and detonated independently of the other holes. Less noise and ground vibrations are generated because several small blasts (delays) are detonated in sequence rather than as one large, instantaneous blast. Blasting can be further controlled by varying the amount of explosive, the type of delay, the delay sequence, the type of explosives, and the type of detonator used. Blasting for the proposed project would take place only during daylight hours and would be conducted under strict Mine Safety and Health Administration safety procedures.

Information on noise emissions from blasting is inconsistent. Noise analyses for development proposals at other Nevada mining facilities (BLM 2004c, 2000d) have assumed blasting noise levels of approximately 115 to 125 dBA at 900 feet from the blast source, lasting for up to 15 seconds. In contrast, field measurements taken at the Pipeline/South Pipeline Pit Complex in 2003 recorded a maximum sound level (L_{max}) of 69.8 dBA at approximately 10,000 feet from the source, lasting for less than 5 seconds, which would be equivalent to approximately 91 dBA at 900 feet, a substantially lower level (BLM 2007d). Subjective observations at other mine sites would indicate even lower levels using modern blasting techniques.

Based on these field measurements and observations, this analysis assumes the lower levels are more representative of the actual blasting noise than the assumed levels used for prior Environmental Impact Statements. The blasting noise maximum emission level used in the analysis was 91 dBA at a 900-foot reference distance.

Using the 91 dBA number, the calculated L_{max} noise levels from blasting at the 5-mile study area perimeter would be approximately 62 dBA. L_{max} is the greatest sound level measured on a sound level meter during a designated time interval or vent, using "fast" time averaging on the meter.

The blasting calculations were based on blasting at the surface with no excess attenuation. As with other pit related noise emissions, the noise from blasting would be increasingly reflected upward by the pit walls as the pit depth increased, which would reduce the noise levels outside the pits.

With modern blasting techniques, blast noise would be experienced by people at the nearest ranch as a brief, muted clap and roll of thunder possibly preceded by a faint warning whistle or siren. Public acceptance is generally improved by scheduling blasting at the same time every day to further reduce the "startle factor."

In summary, with no identified noise-sensitive receptors in the noise effects study area and relatively modest noise level estimates from project-related activities, noise level effects from the proposed project would be negligible.

3.20.2.2 Single Waste Rock Disposal Facility Alternative

The Single WRDF Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of habitat disturbance. Noise emissions from the Single WRDF Alternative would not be measurably different from those anticipated from the proposed project. As a result, all other direct and indirect impacts associated with this alternative would be the same as the Proposed Action.

3.20.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would have a similar footprint as the Proposed Action. Design height and capacity of the West and East WRDF would be significantly different compared to the Proposed Action. The West WRDF would be 230 feet lower and the East WRDF would be 310 feet higher under this alternative and the number of pit lakes would be reduced from three to one. Mining would be sequenced differently from the Proposed Action to allow backfilling portions of the open pit with waste rock during operation. Due to a slower mining rate required to accommodate the sequencing, nine fewer haul trucks and one fewer electric shovel would be used. The slower mining rate would result in a 1-year extension of the mine life.

The Partial Pit Backfill Alternative would result in slightly lower noise emissions than the Proposed Action because of the reduced equipment roster. The distances to the 65 dBA level and to the 10 dBA over background level would be reduced slightly. The effect would likely not be noticeable to the casual observer. The noise would continue for 1 additional year compared with the Proposed Action. There are no identified noise-sensitive receptors in the noise effects study area so the noise level effects of the Partial Backfill Alternative would be negligible.

3.20.2.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and subsequent noise impacts would not occur. Continuation of mining activities associated with the Storm Underground Mine, completion of closure and reclamation activities associated with existing disturbance, and ongoing mineral exploration activities within the study area, would be conducted under existing authorizations. Following these permitted activities, the area would revert to relatively quiet wildlife habitat, agriculture, and dispersed recreation uses, perhaps with some modest influence on noise from other nearby mines.

3.20.3 Cumulative Impacts

The CESA for noise is described in Section 3.20.1, Affected Environment, and is shown in **Figure 3.20-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

Past actions would have no effect on noise in the study area because noise emissions terminate at the completion of a project or activity. Any potential cumulative noise effects from present actions is included in the estimated background levels for the proposed Arturo Mine Project.

3.20.3.1 Proposed Action

Noise from RFFAs would not be expected to cause cumulative effects with noise from the proposed project because noise tends to be localized to the area within 2 to 5 miles of an activity and there are no identified noise sensitive receptors within the 5-mile study area perimeter with the potential to be affected by project-generated noise.

3.20.3.2 Single Waste Rock Disposal Facility Alternative

Noise effects from the Single WRDF Alternative would be the same as for the proposed project. No cumulative noise effects would be expected from this alternative.

3.20.3.1 Partial Pit Backfill Alternative

Noise effects under the Partial Pit Backfill Alternative would be slightly less than effects associated with the Proposed Action. No cumulative noise effects would be expected from this alternative.

3.20.3.2 No Action Alternative

Under the No Action Alternative, noise levels from the proposed project area would decline after completion of the Storm Underground Mine, subsequent reclamation activities, and exploration activities. Noise from identified RFFAs also would decline over time as those projects are completed and reclaimed. Any cumulative noise effects in the study area would be minimal.

3.20.4 Potential Monitoring and Mitigation Measures

No additional monitoring or mitigation measures are recommended for mine-related noise effects.

3.20.5 Residual Impacts

Upon completion of the reclamation activities associated with previously approved projects and the proposed project, noise emissions would cease and there would be no residual noise impacts.

3.21 Environmental Justice

The study area and Cumulative Effects Study Area (CESA) for environmental justice includes Elko County and Eureka County (**Figure 3.21-1**). The rationale for the study area is that the mine would be located in Elko County, adjacent to the Eureka County line and the primary access would pass through northern Eureka County. A substantial majority of the workers would be expected to live in west central Elko County because of a combination of proximity, housing availability, and availability of a broad range of public and private services.

3.21.1 Affected Environment

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was issued February 11, 1994 (59 Federal Register 7629). EO 12898 "is intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities access to public information on, and an opportunity for participation in, matters relating to human health and the environment." It requires each federal agency to achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including social and economic effects, of its programs, policies, and activities on minority and low-income populations.

Pursuant to EO 12898, the Council on Environmental Quality (CEQ) prepared "Environmental Justice: Guidance under the Environmental Policy Act" (CEQ 1997) to assist federal agencies with their National Environmental Policy Act (NEPA) procedures "… so that environmental justice concerns are effectively identified and addressed." This analysis was conducted with the assistance of the CEQ "guidance" document.

The CEQ guidance states that population groups defined as minorities include: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic/Latino origin; or Hispanic/Latino. CEQ guidelines for evaluating potential adverse environmental justice effects indicate minority populations should be identified when either: 1) a minority population exceeds 50 percent of the population of the affected area; or 2) a minority population represents a "meaningfully greater increment" of the affected area population than the population of some appropriate larger geographic unit, as a whole.

Low-income populations are those communities or sets of individuals whose median income is below the current poverty level of the general population. According to the guidance, low-income populations in an affected area should be identified using the "annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty." In identifying low-income populations, (federal) agencies may consider as a community either a group of individuals living in geographic proximity to one another or a set of individuals (such as migrant workers or Native Americans) where either type of group experiences common conditions of environmental exposure or effect" (CEQ 1997).

3.21.1.1 Minority Population

Both Elko and Eureka counties are notably less ethnically and racially diverse than the state as a whole. Eureka County, in particular, is over 83 percent white, non-Hispanic, compared with over 69 percent for Elko County and 54 percent for Nevada (**Table 3.21-1**). Both counties have 1 percent or fewer blacks or Asians, compared with over 7 percent for both groups state-wide. Both counties have lower percentages of Hispanics than the state. Elko County does have a higher percentage of American Indian, Eskimo, or Aleut population with 4.7 percent compared with the state's 0.9 percent. This is largely attributable to the presence of the Elko Band Colony, one of four colonies that comprise the Te-Moak Tribe of Western Shoshone with headquarters in Elko.

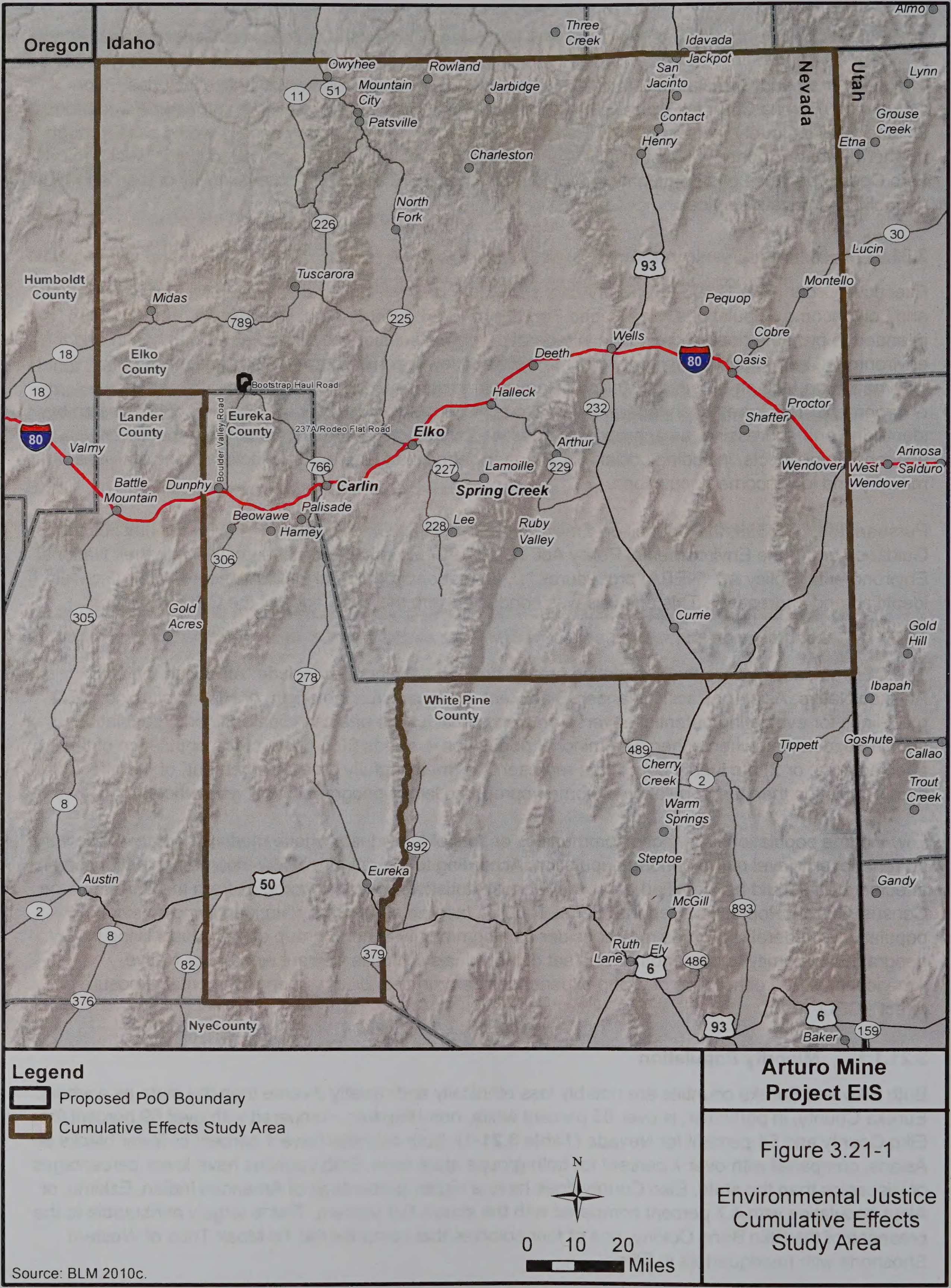


Figure 3.21-1

Environmental Justice Cumulative Effects Study Area

Source: BLM 2010c.

05/21/2012

Table 3.21-1 2010 Race and Ethnicity Percent by County

	Elko County	Eureka County	State of Nevada
White Not of Hispanic Origin	69.1	83.6	54.1
Black Not of Hispanic Origin	0.7	0.1	7.7
American Indian, Eskimo, or Aleut	4.7	2.1	0.9
Asian or Pacific Islander Non-Hispanic	1.0	0.9	7.7
Other and Two or More Races	1.7	1.3	3.1
Hispanic Origin of Any Race	22.9	12.0	26.5

Source: U.S. Census Bureau 2010a.

Census Tract 9517 encompasses much of the rural area of northern Elko County from Humboldt County on the west to the Utah state line on the east. Portions of 13 Census Blocks in Block Group 2 of Census Tract 9517 lie within a 5-mile radius of the project area. All of the proposed surface disturbance would be located in Block 2898. There is no resident population in the census blocks nearest the project area. The total population of Tract 9517 was 2,669 in 2010, scattered among several small communities, ranches, and rural residences. The population was 32.3 percent American Indian and Alaskan Native, and 29.9 percent claimed Hispanic ethnicity. All other minority race categories were very small.

In accordance with the guidance, minority populations should be identified when either:

- The minority population of the affected area exceeds 50 percent; or
- The minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

The population of American Indians does not exceed 50 percent for Elko County. The population percentage of American Indians in Elko County is almost four times greater than for the state as a whole, however, which would be considered "meaningfully greater" than the minority population in the general population. Therefore, for the purpose of identifying environmental justice concerns, a minority population, as defined by the guidance, exists in the study area.

3.21.1.2 Low-Income Population

Although mining is a dominant industry in the study area and mining wages and salaries are typically higher than average, per capita personal income (PCPI) in the study area continues to lag slightly behind the state level. Data from 2000 indicated a state income average of $30,986. Average PCPI for study area counties in 2000 was $25,418 (82.0 percent of the state level) in Elko County and $23,757 (76.7 percent of the state level) in Eureka County (Bureau of Economic Analysis [BEA] 2010). By 2008, the state PCPI had risen to $40,936, an increase of 32 percent. The PCPI for study area counties was $37,300 for Elko County and $40,674 for Eureka County. PCPI in study area counties had grown faster than the state's PCPI and had risen to 91.1 percent of the state level in Elko County and 99.4 percent of the state level in Eureka County (BEA 2010). In contrast to PCPI, estimated median household incomes tell a slightly different story. The median household income for the state for 2009 was estimated at $53,310, compared with $62,091 for Elko County (116.5 percent of the state level) and $56,815 for Eureka County (106.6 percent of the state level) (U.S. Census Bureau 2010b).

Poverty status is determined by comparing annual income to poverty thresholds, which vary by family size, number of children, and age of the householder, although not geographically. Poverty thresholds are updated annually based on changes in the Consumer Price Index. Weighted average poverty thresholds for 2009 ranged from $10,289 for a single individual 65 years and over to $44,366 for a household of nine or more people. Census estimates indicated 12.4 percent of the people in Nevada had incomes below the poverty level in 2009 (U.S. Census Bureau 2010b). Both study area counties had lower percentages of people with incomes below the poverty thresholds than the state: Elko County was at 8.2 percent and Eureka County was at 10.4 percent. Estimates of the percent of young people under age 18 in poverty were higher for both jurisdictions, but the percentages for the two study area counties were below the statewide 17.6 percent. Based on this information, neither of the study area counties would be considered to have low-income populations under EO 12898.

3.21.2 Environmental Consequences

Primary issues related to environmental justice are guided by EO 12898 that initiated consideration of environmental justice in federal actions. The basic question is whether any potential adverse human health or environmental effects of the Proposed Action or alternatives would fall disproportionately on minority or low income members of the affected community.

According to the CEQ guidance, “when determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

- Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and
- Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and
- Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards”(CEQ 1997).

“When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

- Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment; and
- Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and
- Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards” (CEQ 1997).

In order to assess the potential for environmental justice impacts, the socioeconomic characteristics of the study area counties and communities are first analyzed for the presence of minority and/or low income populations. Second, if minority and/or low-income populations are identified based on the CEQ Guidance, the proposed project and alternatives are evaluated for potential effects, which may be expected to disproportionately impact any such populations.

3.21.2.1 Proposed Action

The environmental analyses indicate that the potential effects of the proposed project would not be expected to disproportionately affect any particular population. The area in the immediate vicinity of the proposed project has no resident population. The nearest residences are a few remote ranches located several miles from the project area that have not been identified as minority or low-income in nature. The nearest residential area is approximately 30 miles away at Carlin. Beowawe, the nearest community in Eureka County, is approximately 30 miles south of the proposed project. Elko is nearly 50 miles away by road. The community of Owyhee, on the Duck Valley Indian Reservation in Elko County, is over 60 miles north of the proposed project and the Southfork Indian Reservation, also in Elko County, is over 50 miles southeast of the proposed project. The relatively high proportion of Hispanic or Latino population in Census Tract 9517 is assumed to reside a substantial distance from the project area, as well, because of the scarcity of residences in the project vicinity. By the same rationale, there are no concentrations of low-income people near the project area. Environmental effects that may occur at a greater distance from the proposed project area, such as air quality or traffic effects, would affect the study area's population essentially equally without regard to race, ethnicity, or income level.

Regarding whether "communities have been sufficiently involved in the decision making process," the Bureau of Land Management (BLM) has held three public scoping meetings and distributed public notices about the proposed project through mailings and notices in area newspapers in addition to the formal notice in the Federal Register. There also has been an extensive effort to involve the Native American communities in the process through consultation specific to the proposed project (documented in Section 3.6, Native American Traditional Values, and Chapter 4.0, Consultation and Coordination).

3.21.2.2 Single Waste Rock Disposal Facility Alternative

The Single Waste Rock Disposal Facility (WRDF) Alternative would be similar to the Proposed Action, except that the East WRDF would not be developed and the West WRDF would be expanded by approximately 54 acres. Overall, this alternative would result in approximately 128 fewer acres of habitat disturbance. Implementation of this alternative is expected to have the same effects on minority and low income populations as the proposed project. Consequently, this alternative would not be expected to disproportionately affect any particular population.

3.21.2.3 Partial Pit Backfill Alternative

The Partial Pit Backfill Alternative would require the sequencing of mining to allow backfilling portions of the open pit with waste rock during mining. The mining sequence would be less flexible than under the Propose Action. Under this alternative, delays in the schedule would occur to adjust for transport of waste rock to the East and South Pits. The mining rate would slow by an estimated 22 percent, resulting in a 1-year extension of the mine life. The Partial Pit Backfill Alternative would be expected to have the same effects on minority and low-income populations as the proposed project. Consequently, this alternative would not be expected to disproportionately affect any particular population.

3.21.2.4 No Action Alternative

Under the No Action Alternative, BLM would not approve the proposed project. Mining activities associated with the Storm Underground Mine would continue, closure and reclamation activities associated with existing disturbance would be completed, and mineral exploration activities and reclamation would continue in the study area, all under existing authorizations. Any potential adverse environmental justice effects were addressed in the permitting process for the existing activities.

3.21.3 Cumulative Effects

The CESA for environmental justice is defined in Section 3.21.1, Affected Environment, and is shown in **Figure 3.21-1**. The past, present, and reasonably foreseeable future actions (RFFAs) are discussed in

Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. RFFAs from mining activities are identified in **Table 3.2-1**; their locations are shown in **Figures 3.2-1** and **3.2-2**.

3.21.3.1 Proposed Action

The environmental justice analysis did not identify any disproportionate effects from the proposed project on minority or low-income populations in the study area, and an extensive effort to involve all communities in the decision-making process was documented. Therefore, no disproportionate cumulative effects to these populations would occur as a result of the proposed project.

3.21.3.2 Single Waste Rock Disposal Facility Alternative

No disproportionate adverse effects on minority or low-income populations have been identified for this alternative so there would be no cumulative adverse environmental justice effects from the Single WRDF Alternative.

3.21.3.3 Partial Pit Backfill Alternative

No disproportionate adverse effects on minority or low-income populations have been identified for this alternative, so there would be no cumulative adverse environmental justice effects from the Partial Pit Backfill Alternative.

3.21.3.4 No Action Alternative

No disproportionate cumulative effects to these populations would occur as a result of the No Action Alternative.

3.21.4 Potential Monitoring and Mitigation Measures

No monitoring or mitigation measures are recommended for environmental justice.

3.21.5 Residual Impacts

No disproportionate adverse environmental justice effects were identified so there would be no residual impacts.

3.22 Energy Requirements and Climate Change

Energy requirements and greenhouse gas (GHG) emissions associated with the proposed project would be related to the consumption of energy from mining and processing activities over the 20-year project life. Operations that would contribute to GHG emissions would include:

- Fuel consumption (vehicles and machinery); and
- Electricity consumption (machinery and dewatering).

The 2008 national annual emissions of GHGs were approximately 8 billion tons (U.S. Environmental Protection Agency [USEPA] 2008a, reported in carbon dioxide equivalents (CO_2[e])[1]. In Nevada, the total carbon dioxide (CO_2) emissions from all combustion sources (diesel, gasoline, coal, propane, etc.) were approximately 62 million tons (56.3 million metric tons) (Nevada Division of Environmental Protection [NDEP] 2008). A total of 78 percent of Nevada statewide emissions of CO_2 were from electrical power generation and transportation (NDEP 2008). Approximately 3.5 percent of Nevada CO_2 emissions, which is 2.2 million tons, or 2.0 million metric tons of CO_2 per year, were from mining activities along the Carlin Trend (NDEP 2008).

3.22.1 Energy Requirements

Table 3.22-1 presents fuel (primarily diesel), electrical power usage and associated GHG emissions, for the Proposed Action, Single Waste Rock Disposal Facility (WRDF) Alternative, Partial Pit Backfill Alternative, and No Action Alternative. All alternatives have similar energy use and GHG emissions, except for the No Action Alternative.

3.22.2 Climate Change

3.22.2.1 Climate Change Overview

GHGs consist of compounds in the earth's atmosphere that absorb outgoing long-wave radiation emitted from the earth's surface, resulting in a warming of the atmosphere. Naturally occurring GHGs include CO_2, methane (CH_4), nitrous oxide, and ozone. Although many of these gases occur naturally in the atmosphere, man-made sources have substantially increased the emissions of GHGs over the past several decades. Of the man-made GHGs, the greatest contribution currently comes from CO_2 emissions.

Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks (i.e., vegetation) cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2(e) concentrations to increase dramatically, and are a possible contributor to overall global climatic changes (Intergovernmental Panel on Climate Change [IPCC] 2007).

Global mean surface temperatures have increased nearly 1.8 degrees Fahrenheit (°F) (1.0 degrees Celsius [°C]) from 1890 to 2006 depending on where measurements are reported (Hansen et al. 2010) ard Institute for Space Studies 2007). Northern latitudes (above 24 degrees North) have exhibited

---

[1] CO_2(e) represent the quantity of CO_2 that would be required to produce the same global warming potential (GWP) as any given GHG. Typically, this value is presented over a 100-year period where a given quantity (i.e., 1 pound) of CO_2 has a GWP of 1 and the same quantity of CH_4 has a GWP of 21. Therefore, given the same quantities, CH_4 has an impact 21 times greater than CO_2.

Table 3.22-1 Estimated Fuel and Electrical Power Consumption

Case	Diesel Consumption (gallons)[1]	Power Consumption (kilowatt-hour/year)[1]	Direct GHG (tons per year) CO_2[2]	Indirect GHG (tons CO_2(e) /yr)[2]	Total GHG (tons CO_2(e) /yr)[2]
Proposed Action (stationary sources)	0	60,000	0	25,901	25,901
Proposed Action (mobile sources)	7,227,000	0	80,220	0	80,220
Proposed Action Total	**7,227,000**	**60,000**	**80,220**	**25,901**	**106,121**
Single WRDF Alternative (stationary sources)	0	60,000	0	25,901	25,901
Single WRDF Alternative (mobile sources)	7,727,000	0	85,770	0	85,770
Single WRDF Alternative Total	**7,727,000**	**60,000**	**85,770**	**25,901**	**111,671**
Partial Pit Backfill Alternative (stationary sources)	0	60,000	0	25,901	25,901
Partial Pit Backfill Alternative (mobile sources)	6,814,262	0	75,638	0	75,638
Partial Pit Backfill Alternative Total	**6,814,262**	**60,000**	**0**	**25,901**	**101,539**
No Action Alternative (stationary sources)	0	14,447	0	6,236	6,236
No Action Alternative (mobile sources)	483,719	0	5,369	0	5,369
No Action Alternative Total	**483,719**	**14,447**	**5,369**	**6,236**	**11,606**

[1] BDMV 2011b.

[2] USEPA 2011.

temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

At present, there is no regulatory program which requires reductions in GHG emissions. However, in response to a Supreme Court decision interpreting the Clean Air Act, on July 30, 2008, the USEPA published an advance notice of proposed rulemaking addressing regulatory mechanisms for regulating GHG emissions for purposes of addressing climate change. Congress also may consider legislation that would impose regulatory controls or incentives for reducing GHG emissions.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends (USEPA 2008b). It should be noted however, that while many in the scientific community assert that increases in global mean surface temperature are undoubtedly caused by increases in global GHG concentrations, others continue to debate this theory for varying reasons, including uncertainty in the empirical evidence and theoretical models (Waugh 2011) and neither side may ever be swayed from their beliefs and theories.

A recent study provides further evidence that the earth is getting warmer. The Berkeley Earth Surface Temperature study (Berkeley 2011) found reliable evidence of a rise in the average world land temperature of approximately 1.8°F (1°C) since the mid-1950s (Science Daily 2011). Analyzing temperature data from 15 sources, in some cases going as far back as 1800, the Berkeley Earth Surface Temperature study directly addressed scientific concerns raised by climate change skeptics, including the urban heat island effect, poor station quality, and the risk of data selection bias.

Specifically, the Berkeley Earth Surface Temperature study concluded that:

- The urban heat island effect is locally large and real, but does not contribute significantly to the average land temperature rise. That is because the urban regions of Earth amount to less than 1 percent of the land area.
- About one-third of temperature sites around the world reported global cooling over the past 70 years (including much of the United States and northern Europe). But two-thirds of the sites show warming. Individual temperature histories reported from a single location are frequently noisy and/or unreliable, and it is always necessary to compare and combine many records to understand the true pattern of global warming.

The large number of sites reporting cooling might help explain some of the skepticism of global warming. In fact, it is very hard to measure weather consistently over decades and centuries, and the presence of sites reporting cooling is a symptom of the noise and local variations that can creep in. A good determination of the rise in global land temperatures cannot be done with just a few stations: it takes hundreds – or better, thousands – of stations to detect and measure the average warming. Only when many nearby thermometers reproduce the same patterns can we know that the measurements were reliably made.

Stations ranked as "poor" in a survey by Anthony Watts and his team of the most important temperature recording stations in the United States, (the United States Historical Climatology Network -- known as the USHCN), showed the same pattern of global warming as stations ranked as “OK.” Absolute temperatures of poor stations may be higher and less accurate, but the overall global warming trend is the same, and the Berkeley Earth Surface Temperature analysis concluded that there is not any undue bias from including poor stations in the survey.

Another recent study titled The Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation concluded that climate change would likely lead to global increases in extreme weather, along with heightened risks to livelihoods, human health, and infrastructure, both today and in the future (IPCC 2011). This report also describes the costs -- in terms of lives lost and economic damages -- that have already occurred, plus those that would likely result from this phenomenon, and the societal implications of a warmer world, in which yesterday's extreme conditions become the new norm.

Climate change analyses are comprised of several factors including, but not limited to, GHGs, land use management practices, and the albedo effect (the fraction of solar radiation reflected by a surface or object). While emissions from mining activities may contribute to the effects of climate change to some extent, it is currently not possible to associate any particular actions with the creation of any specific climate-related environmental effects. The tools necessary to quantify climatic impacts presently are unavailable. As a consequence, impact assessments of specific effects of man-made activities cannot be determined. Therefore, climate change analysis for the purpose of this document is limited to accounting and disclosing of GHG emissions that may contribute to climate change.

3.22.2.2 Proposed Project and Climate Change

Historically, the climate in the project area (the Great Basin Desert) has been highly variable due to its location in respect to atmospheric circulation patterns and the surrounding complex topography. However, it is highly probable that temperatures in North America will rise over the next 100 years with temperatures in the western United States increasing between 2.5 and 6°C relative to pre-1900 levels (Christensen et al. 2007). These increased temperatures will have numerous impacts, including diminished water resources related to longer periods of drought, snowpack dissipation due to warmer temperatures (snow will occur later in the year and melt sooner) (Bureau of Reclamation 2011), and a direct effect on ozone which has been shown to have increased ground level concentrations due to increasing temperature (USEPA 1998b).

The proposed project would emit CO_2(e) that would incrementally add to the GHGs in the region from other sources including power plants, mining activities, industrial operations, vehicle traffic, wildfires, and other activities as identified in Section 3.2, Past, Present, and Reasonably Foreseeable Future Actions. The proposed project, including the Proposed Action, Single WRDF Alternative, and the Partial Pit Backfill Alternative, represents approximately 1 percent of the GHG emissions from all sources in the region, approximately 0.04 percent of the emissions in Nevada, and a tiny fraction of the emissions on a global basis. As a result, the proposed project would be expected to have a negligible effect on climate.

3.23 Relationship between Short-term Uses of the Human Environment and the Maintenance and Enhancement of Long-term Productivity

As described in the introduction to Chapter 3.0, short-term is defined as the 8-year mine life of the project and a 4-year reclamation period; long-term is defined as the future following reclamation (i.e., beyond 12 years). This section identifies the tradeoffs between the short-term impacts to environmental resources during operation and reclamation versus the long-term impacts to resource productivity that would extend beyond the end of reclamation.

The short-term use of resources during the expansion, operation, and reclamation of the proposed project would result in beneficial impacts in the form of an extension of local employment and the generation of revenue.

The proposed project would result in various short-term impacts, such as the temporary loss of soil and vegetation productivity and the associated loss of wildlife habitat, possible wildlife avoidance and displacement, a reduction in dispersed recreation opportunities, temporary increases in fugitive dust, and increased noise levels. These impacts are expected to end upon completion of operations and would be minimized through implementation of applicant-committed environmental protection measures.

The short-term visual impacts would last a few years beyond mine closure and gradually would be reduced as vegetation becomes more established. The scale and extent of the facilities would continue to alter the local landscape and views in the long term.

Impacts to long-term productivity (i.e., following project reclamation) primarily would depend on the effectiveness of the proposed reclamation of the disturbance areas. Successful reclamation would provide for post-mining wildlife and self-sustaining plant communities. Revegetation also is expected to stabilize disturbed surfaces and control erosion.

There would be a long-term loss in soil and vegetation productivity and associated terrestrial wildlife habitat, a reduction in livestock grazing areas, and public lands used for dispersed recreation that would not be reclaimed.

3.24 Irreversible and Irretrievable Commitment of Resources

The proposed project could result in the irreversible commitment of resources (e.g., the loss of future options for resource development or management, especially of nonrenewable resources such as minerals or cultural resources) or the irretrievable commitment of resources (e.g., the lost production or use of renewable natural resources during the life of the operations). Irreversible and irretrievable impacts of the proposed project are summarized for each resource in **Table 3.24-1**.

Table 3.24-1 Irreversible and Irretrievable Commitment of Resources by the Proposed Action

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Geology and Minerals	Yes	Yes	Approximately 64 million tons of gold ore would be mined during operations. This would result in the irreversible and irretrievable commitment of this resource.
Water Quality and Quantity (Surface and Ground) and Water Use	Yes	Yes	Evaporation from the pit lake would result in an irreversible and irretrievable impact to surface water quality within the pit lake.
Cultural Resources	Yes	Yes	Although data recovery would be completed at 29 historic properties, irreversible and irretrievable impacts to these sites would occur because the sites ultimately would be destroyed by project construction and some of their data would be lost. Irreversible and irretrievable indirect and cumulative impacts to sites not undergoing data recovery would occur.
Native American Traditional Values	No	No	Adverse effects to religious, spiritual, or sacred values cannot be monitored or mitigated.
Hazardous Materials and Solid Waste	No	No	No irreversible or irretrievable commitment of resources or impact is anticipated. However, if a spill were to affect a sensitive resource, an irretrievable impact could occur pending the recovery of the resource.
Air Quality	No	No	Project emissions would not exceed federal or state Ambient Air Quality Standards. Air quality would return to existing conditions after completion of the project.
Paleontological Resources	Yes	Yes	There would be an irretrievable and irreversible loss of any paleontological resources in Carlin Formation areas buried by the waste rock disposal facilities.
Social and Economic Values	No	Yes	Labor and some capital resources, once committed and expended, would not be retrievable.
Recreation and Wilderness	Yes	Yes	There would be an irretrievable loss of public land available for dispersed recreational opportunities during operations and reclamation. An irreversible loss would occur on approximately 472 acres of public land previously reclaimed or newly disturbed associated with the expansion of the existing open pit, which would not be reclaimed. No irreversible or irretrievable commitment or impact of wilderness resources is anticipated.
Visual Resources	Yes	No	Impacts to visual resources would be reduced through successful reclamation procedures and implementation of the environmental protection measures. However, permanent changes would result.

Table 3.24-1 Irreversible and Irretrievable Commitment of Resources by the Proposed Action

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Soils	Yes	Yes	Suitable growth media would be salvaged from the mine disturbance areas for use in reclamation. There would be a loss of soil productivity during operations on approximately 1,962 previously undisturbed acres and 543 previously disturbed but reclaimed acres, resulting in an irretrievable commitment of 2,505 acres of this resource. There would be an additional irreversible commitment of the resource on approximately 472 acres previously reclaimed or undisturbed associated with the expansion of the open pit, which would not be reclaimed.
Vegetation, including Riparian Zones and Wetlands	Yes	Yes	There would be an irretrievable commitment of vegetation resources on approximately 1,962 previously undisturbed acres and 543 previously disturbed but reclaimed acres during operations. There would be an additional irreversible commitment of the resource on approximately 472 acres (previously reclaimed or undisturbed) associated with the expansion of the open pit, which would not be reclaimed. An irreversible and irretrievable impact to riparian zones and wetland resources is anticipated, which would be mitigated by the offsite enhancement of wetlands.
Noxious Weeds and Invasive Species	No	No	Disturbance areas within the proposed project area would be monitored to identify any noxious weeds and invasive species. If populations were observed within the proposed project area during operations, they would be removed. Successful reclamation of disturbance areas also would minimize the potential for establishment of noxious weeds and invasive species within the proposed disturbance area.
Range Resources	Yes	Yes	There would be an irretrievable commitment of range resources on approximately 3,357 acres with a suspension of approximately 687 animal unit months (AUMs) during operations. An irretrievable loss of 95 AUMs would occur within the Twenty Five Allotment from the expansion of the open pit, which would not be reclaimed.
Wildlife and Aquatic Biological Resources	Yes	Yes	There would be an irretrievable commitment of sagebrush shrubland, grassland, and riparian zone and wetland area wildlife habitat on approximately 2,505 acres during operations. There would be an additional irreversible commitment of the resource on approximately 472 acres of sagebrush shrubland, and grassland associated with the expansion of the existing open pit, which would not be reclaimed.
Special Status Species	Yes	Yes	Same as described above for Wildlife and Aquatic Biological Resources.

Table 3.24-1 Irreversible and Irretrievable Commitment of Resources by the Proposed Action

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Access and Land Use	Yes	No	There would be no irreversible or irretrievable impacts to access; public access patterns would be maintained. An irreversible loss would occur on approximately 472 acres of public land associated with the expansion of the existing open pit, which would not be reclaimed.
Noise	No	No	Noise is not considered irreversible because it would cease following the completion of mine operations.
Environmental Justice	No	No	The proposed project would not disproportionately affect minority or low-income populations.
Energy Requirements and Climate Change	No	Yes	There would be irretrievable energy consumption during the operations and reclamation. The proposed project would be expected to have a negligible effect on climate.

4.0 Consultation and Coordination

This chapter reviews agency and public consultation and coordination that occurred prior to and during preparation of this Environmental Impact Statement (EIS). It also includes the list of agencies and individuals who received the draft document.

4.1 Public Participation and Scoping

This environmental document was prepared in consultation and coordination with various federal, state, and local agencies, organizations, and individuals. Agency consultation and public participation have been accomplished through a variety of formal and informal methods, including scoping meetings, responses to e-mails, and meetings with individual public agencies and interest groups. This section summarizes these activities.

Public involvement in the EIS process includes the steps necessary to identify and address public concerns and needs. The public involvement process assists agencies in: 1) broadening the information base for decision making; 2) informing the public about proposed actions and potential long-term impacts that could result from projects; and 3) ensuring that public needs are understood by the agencies.

Public participation in the EIS process is required by the National Environmental Policy Act at four specific points: scoping period, review of Draft EIS, review of Final EIS, and receipt of the Record of Decision (ROD).

- Scoping: The public is provided a 30-day scoping period to disclose potential issues and concerns associated with the Proposed Action. Information obtained by the agencies during public scoping is combined with issues identified by the agencies and which forms the scope of the EIS.
- Draft EIS Comment Period: A 45-day Draft EIS comment period is initiated by publication of an Notice of Availability (NOA) for the Draft EIS in the Federal Register (FR).
- Final EIS Review: A 30-day Final EIS availability period is initiated by publication of the NOA for the Final EIS in the FR.
- ROD: Subsequent to the 30-day availability period for the Final EIS, the ROD would be prepared.

4.1.1 Scoping

The Bureau of Land Management (BLM) initiated the public scoping process by publishing a Notice of Intent to prepare an EIS in the FR on June 21, 2010 (FR Volume 75, Number 118). Public scoping meetings were held on July 6, 2010, in Owyhee; July 7, 2010, in Battle Mountain; and July 8, 2010, in Elko, Nevada, to obtain input on issues and concerns to be evaluated in the EIS. The public scoping meetings were conducted in an open house format. Attendees were provided information about the project and given an opportunity to ask resource specialists and BLM representatives questions, as well as express their concerns.

The BLM received a total of 15 comment submittals (e.g., letter, comment form, or email) during the scoping period, resulting in a total of 143 comments and questions. Most of the comments the BLM received were from federal and state agencies. Scoping comments were used to help determine the scope of issues to be addressed and help identify the significant issues related to the Proposed Action. The Public Scoping Comment Summary Report for this EIS (BLM 2010h) provides a detailed table listing each individual comment, its source, and where the comment will be addressed in the EIS. **Table 4-1** describes the distribution of scoping comments by organization. The key issues identified during the scoping process included:

- Impacts to water resources (surface water and groundwater);
- Impacts to ecosystems, rangeland resources, and wildlife; and
- Air emissions impacts, including mercury.

Table 4-1 Scoping Comments Distribution

Organization Name	Total Number of Comments
Advisory Council on Historic Preservation	3
Bureau of Reclamation	2
Nevada Division of Environmental Quality	3
Nevada Department of Transportation	1
Nevada Department of Wildlife (3) (NDOW)	5
Nevada Division of Water Resources	1
Public Citizens (4)	7
State Historic Preservation Office (SHPO)	1
United States Fish and Wildlife Service (USFWS)	3
United States Environmental Protection Agency (USEPA)	117
Total	**143**

4.1.2 Public Review of the Draft EIS

The Draft EIS will be available for the 45-day public review and comment period from the date the NOA is published in the FR. Public meetings will be held in Owyhee, Battle Mountain, and Elko, Nevada during the 45-day comment period.

4.2 Consultation and Coordination with Federal, State, and Local Agencies, and Tribes

Issues related to agency consultation and review included mining regulation and reclamation, biological resources, cultural resources, socioeconomics, and land and water management. Cultural resource consultations apply to the potential for impacts to important historic, archaeological, or traditional sites important to Native Americans. A Memorandum of Agreement between the BLM and Nevada SHPO will be utilized for this EIS. The BLM and SHPO consulted and concurred on the treatment plan.

The USFWS provided input on the potential for federally listed, proposed, and candidate species within the proposed project area. Additional comments included concerns relative to species protected under the Migratory Bird Treaty Act, avian collision, wetlands, and cumulative groundwater pumping.

The USEPA provided comments on a wide variety of topics including the development of alternatives mitigation measures, surface water and groundwater quality and quantity, management of leachate, waste rock characterization and placement, closure and reclamation, air quality, waters of the United States, sensitive species, environmental justice, and socioeconomics.

As the state agency with jurisdiction and special expertise related to impacts on wildlife, NDOW participated as a cooperating agency in the preparation of this EIS. NDOW was primarily concerned with the placement of the West Waste Rock Disposal Facility relative to big game movement through the proposed project area. NDOW also provided information on mule deer migration corridors, as well as information on sage-grouse, mule deer, and antelope use areas.

In addition, the Elko County Commission also agreed to participate as a cooperating agency to review an analysis of the socioeconomic impact of mining on the county.

Under Executive Order 13084, the BLM is required to establish regular and meaningful consultation and collaboration with Native American tribal governments on the development of regulatory policies and issuance of permits that could significantly or uniquely affect their communities. On October 1, 2009, the BLM sent letters to the following tribes, bands, and interested parties notifying them of the project:

- Battle Mountain Band;
- Shoshone-Paiute Tribes of the Duck Valley Indian Reservation;
- Elko Band;
- Duckwater Shoshone Tribe;
- Ely Shoshone Tribe;
- Confederated Tribes of the Goshute Reservation;
- South Fork Band;
- Te-Moak Tribe of Western Shoshone;
- Wells Band Council;
- Yomba Shoshone Tribe; and
- Interested Parties
  - Bureau of Indian Affairs
  - Western Shoshone Committee
  - Western Shoshone Defense Project
  - Western Shoshone Descendents of Big Smoky Valley.

The BLM presented project information and maps at the Battle Mountain Band Meeting on February 25, 2010. In addition, Native American field trips to the proposed project area occurred on August 27 and October 1, 2010. The field visits provided an opportunity for the Tribes and bands to view the proposed project area and identify any sites or places that may be of tribal importance. Any specific information provided by Tribal members concerning Native American traditional use and/or spiritual sites in or near the proposed project area will remain confidential. Consultation with the contacted Tribes and bands is ongoing and would continue up to and including project construction.

4.3 List of Contacts

The following agencies, businesses, organizations, and individuals were contacted in the course of preparing this EIS.

4.3.1 Federal Agencies

Advisory Council on Historic Preservation

Bureau of Land Management – Nevada State Office, Reno

Bureau of Land Management – Washington, D.C.

Bureau of Reclamation – Carson City, NV

Library of Congress Exchange and Gift Division – Washington, D.C.

Office of Public Affairs – Washington, D.C.

U.S. Army Corps of Engineers – Reno, NV

U.S. Army Corps of Engineers – Sacramento, CA

U.S. Department of Agriculture Cooperative Extension Service – Fallon, NV

U.S. Department of Agriculture, Forest Service Humboldt Toiyabe National Forest – Elko, NV

U.S. Department of Agriculture, Forest Service Ruby Mountain/Jarbidge Ranger Stations – Wells, NV

U.S. Department of Energy, Office of Environmental Compliance – Washington, D.C.

U.S. Department of the Interior, Bureau of Indian Affairs – Washington, D.C.

U.S. Department of the Interior, Natural Resources Defense Council – Washington, D.C.

U.S. Department of the Interior, Natural Resources Library, Gifts and Exchange Section – Washington D.C.

U.S. Department of the Interior, Office of Environmental Policy and Compliance – Washington, D.C.

U.S. Department of the Interior, Office of the Secretary, Office of Environmental Policy and Compliance – Oakland, CA

U.S. Environmental Protection Agency – Las Vegas, NV

U.S. Environmental Protection Agency – San Francisco, CA

U.S. Environmental Protection Agency, Office of Federal Activities – San Francisco, CA

U.S. Environmental Protection Agency, Office of Federal Activities – Washington, D.C.

U.S. Fish and Wildlife Service – Arlington, VA

U.S. Fish and Wildlife Service – Reno, NV

U.S. Geological Survey – Denver Federal Center, Denver, CO

U.S. Post Office – Elko, NV

U.S. Post Office – Tuscarora, NV

4.3.2 State Agencies

Great Basin College, USDA Cooperative Extension Service

Nevada Commission on Tourism, Motorsports Manager

Nevada Department of Agriculture

Nevada Department of Transportation – Carson City, NV

Nevada Department of Transportation – Elko, NV

Nevada Division of Environmental Protection/Bureau of Mining Regulation and Reclamation

Nevada Division of Forestry
Nevada Division of Minerals
Nevada Division of Water Resources
Nevada Division of Wildlife
Nevada Mining Association
Nevada State Clearing House
Nevada State Historic Preservation Office
University of Arizona – James E. Rogers College of Law
University of Colorado
University of Nevada, Cooperative Extension, Area of Natural Resources
University of Nevada-Reno – Department of Mining Engineering
University of Nevada-Reno – Department of Range, Wildlife, and Forestry

Nevada Department of Wildlife – Elko, NV

4.3.3 Elected Officials

Theodore Beutel – Eureka County District Attorney
John Carpenter – State Assemblyman, Elko, NV
John Ensign – State Assemblyman, Reno, NV
Pete Goicoechea – State Assemblyman, Eureka, NV
Don Gustavson – State Assemblyman, Sparks, NV
Dean Heller – U.S. Senator
Harry Reid – U.S. Senator
Dean Rhoads – Rural Nevada Senatorial District
City Mayor – Carlin, NV
City Mayor – Elko, NV
Public Administrator – Winnemucca, NV

4.3.4 Local Agencies

Carlin Planning Board
City of Elko
City of Wells
Elko Chamber of Commerce
Elko City Manager
Elko City Planning Board
Elko County Board of Commissioners
Elko County Commission
Elko County Commissioner

Elko County Public Works Department

Elko County School District

Elko Public Land Use Planning Commission

Eureka County Commissioners

Eureka County Department of Natural Resources

Eureka County Public Land Advisory Commission

Humboldt County Board of Commissioners

Humboldt River Basin Water Authority

Lander County Clerk

Lander County Planning Commission

Mineral County Board of Commissioners

Mineral County Chamber of Commerce

Mineral County Clerk

Mountain City, Nevada Post Office

Owyhee Post Office

Wells Chamber of Commerce

Winnemucca Chamber of Commerce

4.3.5 Tribal Organizations

Battle Mountain Band Council

Bureau of Indian Affairs – Eastern Nevada Agency

Shoshone-Paiute Tribes of the Duck Valley Indian Reservation

Duckwater Shoshone Tribe

Elko Band Council

Ely Shoshone Tribe

Goshute Business Council

South Fork Band Council

Te-Moak Tribe of Western Shoshone

Wells Band Council

Western Shoshone Committee

Western Shoshone Defense Council

Western Shoshone Defense Project

Western Shoshone Descendents of Big Smoky Valley

Yomba Shoshone Tribe

4.3.6 Newspapers and Libraries

Elko County Library

Eureka County Library

Great Basin College Library

Lander County Library

Nevada State Library

Nevada State Library and Archives

University of Nevada Libraries, Business and Government Information Center

University of Nevada-Las Vegas, James Dickinson Library

University of Nevada-Reno, Delamare Library

4.3.7 Private Organizations and Companies

25 Ranch LLC

Adobe Hills Ranch, LLC

AFS, Water Quality Section

Agri Beef Company

Allied Nevada Gold Holdings

American Horse Protection Association

Animal Welfare Institute

ATNA Resources, Incorporated

Bamco Exploration, Inc.

Baroid Drilling Fluids, Inc.

Barrick Gold Exploration, Inc.

Barrick Gold of North America

Barrick Goldstrike Mines, Inc.

Boss Tanks

Cameco U.S., Incorporated

Citizens Against Recreation Eviction USA

Colorado Wild Horse and Burro Coalition

Committee for Idaho's High Desert

Cortez Gold Mines

Dee Gold Mine

Earth Works

Ellison Ranching Company

Evolving Gold Corporation

Friends of Nevada Wilderness

Friends of Nevada Wildlife

Fronteer Development USA, Incorporated

Glamis Marigold Mine

Glendale Ranches

Great Basin Ecology, Incorporated

Great Basin Gold, Limited

Great Basin Resource Watch

Halliburton Energy Service Incorporated

Hawkwatch International

Hecla Ventures Corporation

Hi-Tech Exploration LTD

Humboldt Outfitters, Incorporated

Intermountain Water Alliance

Intertech Services Corporation

Isaiah Capital Trust

Largo Flight LTD

Maggie Creek Ranch

Marigold Mining Company

Meridian Minerals Corporation

Meridian Rossi Corporation

Mineral Policy Center – Washington, D.C.

Mines Regulations Reporter

Minex Resources, Incorporated

National Mustang Association, Inc. – National Headquarters

Natural Resources Defense Council

Natural Resources Management Advisory Commission – Elko, NV

Need More Sheep Company

Nevada Archeological Association

Nevada Energy – Elko

Nevada Energy – Las Vegas

Nevada Energy – Reno

Nevada High Country Tours

Nevada Land Action Association and Nevada Cattlemen's Association

Nevada Mining Association

Nevada Outdoor Recreation Association

Nevada Trend Exploration

Nevada Wilderness Project

Nevada Wildlife Federation, Incorporated

Nevada Woolgrowers Association

Newmont Mining Corporation

Ormsby Sports Club

Parsons, Behle, and Latimer

Public Lands Foundation – Arlington, VA

Public Resource Association

Queenstake Resources USA, Incorporated

Range Magazine

Rayrock DBS Cordex Exploration

Red Rock Audubon Society

Resource Concepts Incorporated

Rodeo Creek Gold, Incorporated

Royal Gold

Ruby Lake National Wildlife Refuge

Sierra Club – San Francisco, CA

Sierra Club – Washington, D.C.

Sierra Club, Toiyabe Chapter – Reno, NV

Sierra Pacific Power Company – Elko, NV

Sierra Pacific Power Company – Reno, NV

Squaw Valley Ranch, LLC

Sustainable Grazing Coalition

The Nature Conservancy

The Wilderness Society

Tri Quest Resources – Southwood Lodge Lake

TS Joint Venture

Western Cultural Resource Management

Western Watersheds Project

White Knight Gold (US) Incorporated

Wild Horse Commission

Wild Horse Organized Assistance

Wild Horse Spirit

Wilderness Impact Research Foundation

Wild Horse Observers Association

Wildlife and Habitat Protection

4.3.8 Individuals

Bauman, Jim
Beatler, Joe
Beitia, Dan
Clinton, Carol
Collins, Jim
Collord, Leta
Coltharp, Hugh & Myrtle
Conley, Ken
Daniel, John
Davis, Richard L.
Dubois, Mark
Ellison, John
Enos, Tom
Fiorenzi, Lenny
Jennifer Garrett
Geddie, John
Haddock, Rich
Hatch, Robert
Haye, Stan
Hoffman, Lee
Houston, Bill
Ingersoll, Bob
Johnson, Bryan
Johnson, Don
Lococo, Andrea
MacDonald, Cindy
Marshall, Laurel
Michna, Robert
Morris, Don
Myers, Charlie
Noel, Dotta
Pattani, F. J.
Pescio, Carl
Pettit, Paul & Valery
Pond, Jim
Redfern, Richard
Salisbury, Ray
Sanders, Mark
Scholl, Roger
Seal, Thom
Slagowski, Carl
Sweide, Alan
Syrjala, Edward S.
Todd, Jerry
Watson, Jason
Wilshire, Dr. Howard

5.0 List of Preparers and Reviewers

5.1 Bureau of Land Management EIS Team

Responsibility	Name
BLM Project Lead, Surface Water Quality and Quantity, Groundwater Resources and Geochemistry, Soils and Watersheds, Air Quality, Socioeconomics, Environmental Justice	John Daniel
Geology and Minerals	Deb McFarlane
Geology and Minerals, Access and Land Use, Paleontological Resources, Reclamation, Noise	Janice Stadelman
NEPA Coordinator	Victoria Anne
Air Quality and Monitoring	Craig Nicholls, Ethan Auman
Cultural Resources; Native American Traditional Values	Bill Fawcett
Visual Resources, Recreation and Wilderness	Zack Pratt
Grazing Management, Vegetation, Special Status Plant Species	Jerrie Bertola
Invasive Nonnative and Noxious Weed Species	Bryan Mulligan
Hazardous Materials and Solid Wastes	Tom Schmidt
Riparian Zones and Wetland Areas	Carol Evans, Russell Miller
Wildlife Resources, Special Status Species; Vegetation; Riparian and Wetlands	Nycole Burton
Hydrology	Tom Olsen
Cooperating Agency – Nevada Department of Wildlife	Katie Gillies, Alan Jenne
Cooperating Agency – Elko County Commissioner	Randy Brown

5.2 AECOM EIS Team (Third-party Consultant)

Responsibility	Name
Project Manager	Scott Duncan
Assistant Project Manager	Evelyn Bingham
Project Coordinator	Julie Barraza
Geology and Minerals, Groundwater	Patrick Plumley (Plumley and Associates Inc.)
Geochemistry	James (Tim) Drever (Consultant)
Geotechnical	Debora Miller (Miller Geotechnical Consultants Inc.)
Surface Water	Jim Burrell
Vegetation (including special status species), Invasive Noxious Plant Species, Riparian and Wetlands, Range Management	Erin Bergquist

Responsibility	Name
Public Participation	Peggy Roberts
Wildlife (including special status species)	Matt Brekke
Aquatic Resources (including special status species)	Rollin Daggett
Soils, Watersheds, Reclamation	Terra Mascarenas
Hazardous and Solid Wastes, Paleontological Resources	William Berg
Cultural Resources, Native American Traditional Values	Kim Munson
Ethnography	Michelle (Shelly) Raven Tiley (Pacific Legacy, Inc.)
Air Quality	Vince Scheetz
Social and Economic Resources, Land Access and Use; Environmental Justice; Noise, Recreation, Wilderness	Bernie Strom (Planera)
Visual Resources	Merlyn Paulson
GIS/Graphics Preparation	Scott Mackinnon
Document Production	Ruth Idler

5.3 Barrick Dee Mining Venture Reviewers

Name	Title and Company
Jessica Spiegel	Regional Permitting Specialist, Barrick Gold of North America
Gary Goodrich	Environmental Superintendent, Barrick Gold Mines Inc.
Steve Schoen	Regional Permitting Manager, Barrick Gold of North America
Ken Morgan	Chief Mining Engineer, BDMV
Ted Grandy	Assistant General Counsel, Barrick Gold of North America
Jim Butler	Attorney, Parsons Behle & Latimer LLP

6.0 References

AATA International. 2006. Betze-Post Mine Spring and Seep Study, Fall 2005. Prepared for Barrick Goldstrike Mines Inc., April 2006. AATA International, Inc., Fort Collins, Colorado.

Air Sciences Inc. 2010a. PM_{10}, SO_2, NO_X, CO, and HAP Emissions from Processing Ore from the Arturo Mine at the Barrick Goldstrike Mine. Technical Memorandum Prepared for S. Schoen, Barrick Gold of North America. Prepared by E. Steen, Air Sciences Inc. October 20, 2010.

_____. 2010b. $PM_{2.5}$, Emissions from Processing Ore from the Arturo Mine at the Barrick Goldstrike Mine. Technical Memorandum Prepared for S. Schoen, Barrick Gold of North America. Prepared by E. Steen, Air Sciences Inc. October 20, 2010.

_____. 2010c. Mercury Emissions from Processing Ore from the Arturo Mine at the Barrick Goldstrike Mine. Technical Memorandum Prepared for S. Schoen, Barrick Gold of North America. Prepared by E. Steen, Air Sciences Inc. October 20, 2010.

Arcadis. 2010. Ecological Risk Assessment for the Proposed Future Arturo Mine Pit Lakes. Arturo Project, Prepared for Barrick Dee Mining Venture. September 16, 2010.

Area 6 Mule Deer Working Group. 2010. Final Area 6 Mule Deer Working Group Habitat Management Plan. Prepared by Newmont, Barrick Goldstrike, Nevada Department of Wildlife, and the Bureau of Land Management. February 2012.

Arizona Game and Fish Department (AGFD). 1993. Arizona Wildlife Views, Bats of Arizona. Arizona Game and Fish Department, Phoenix, Arizona. 30 pp.

Armuth, D. 2008. Comptroller, Elko County. Elko, Nevada. Personal communication with B. Strom, ENSR. May 23, 2008.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C., and Sacramento, California.

Barrick Dee Mining Venture (BDMV). 2012. Barrick Dee Mining Venture data transmittals to AECOM in support of the Draft EIS. January 2012 – May 2012.

_____. 2011a. Barrick Dee Mining Venture data transmittals to AECOM in support of the Draft EIS. January 2011 – December 2011.

_____. 2011b. Partial Pit Backfill, GHG data. Email data transmittal to S. Duncan, AECOM from J. Spiegel, Barrick Gold North America. November 21, 2011.

_____. 2010a. Barrick Dee Mining Venture data transmittals to AECOM in support of the Draft EIS. April 2010 – December 2010.

_____. 2010b. Geologic cross-sections through the overburden storage areas, heap leach facility and open pit. Data transmitted to S. Duncan, AECOM from S. Brower, Barrick Gold North America, Arturo Project Manager. August 20, 2010.

_____. 2010c. Hazardous Waste Data Request from AECOM on July 14, 2010. Memo to AECOM from S. Brower, Barrick Gold North America, Arturo Project Manager. July 15, 2010.

_____. 2010d. Data transmittal in support of Draft EIS. Dee Arturo Mine Precipitation Data 2002-2005. Data received April 16, 2010.

_____. 2010e. Memorandum of June 17, 2010, to the Arturo Project hydrology file from S. Brower, Barrick Gold North America, Arturo Project Manager, presenting flow and water quality data for upper Boulder Creek.

_____. 2010f. Personal communication with B. Strom, AECOM and S. Brower, Barrick Gold North America. December 20, 2010.

Barrick Gold of North America, Inc. 2012. As-built of Tails Dam #2 at the Arturo Mine Project. Memo to J. Daniel, BLM and S. Duncan, AECOM from J. Spiegel, Barrick Gold North America. January 23, 2012.

Barrick Goldstrike Mines Inc. (BGMI). 2010. Boulder Valley Monitoring Plan, Fourth Quarter 2009 and First Quarter 2010 Report. Submitted to the Nevada Division of Water Resources, Office of the State Engineer, Carson City, Nevada. Barrick Goldstrike Mines Inc., Elko, Nevada.

Battelle. 2001. Comparative Risks of Hazardous and Non-hazardous Materials Truck Accidents/Incidents. Final Report. Prepared for the Federal Motor Carrier Safety Administration March 2001. Internet website: http://www.fmcsa.dot.gov/safety-security/hazmat/reports/report-archives.htm. Accessed November 17, 2010.

Bengston, G. 2003. *Northern Paiute and Western Shoshone Land Use in Northern Nevada: A Class I Ethnographic/Ethnohistoric Overview.* BLM-Nevada Cultural Resource Series No. 12, Reno, Nevada.

Berkeley. 2011. Berkeley Earth Surface Temperature Project. Preliminary Findings. Internet website: http://www.BerkeleyEarth.org. Accessed December 12, 2011.

Bernard, M. 2010. Natural History of the Pacific Chorus Frog (*Pseudacris regilla*). Internet website: http://www.mister-toad/PacificTreeFrog.html. Accessed July 07, 2010.

Bradley, P. V., M. J. O'Farrell, J. A. Williams, and J. E. Newmark, Editors. 2006. The Revised Nevada Bat Conservation Plan. Nevada Bat Working Group. Reno, Nevada. 216 pp.

Braun, C. E. 1986. Changes in Sage Grouse Lek Counts with Advent of Surface Coal Mining. Proceedings: Issues and Technology in the Management of Impacted Western Wildlife, Thorne Ecological Institute 2:227-231.

Bryce, S. A., A. J. Woods, J. D. Morefield, J. M. Omernik, T. R. McKay, G. K. Brackley, R. K. Hall, D. K. Higgins, D. C. McMorran, K. E. Vargas, E. B. Petersen, D. C. Zamudio, and J. A. Comstock. 2003. Ecoregions of Nevada (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,350,000).

Bureau of Economic Analysis (BEA). 2010. Local Area Annual Personal Income. Regional Economic Information System, U.S. Department of Commerce. Washington, D.C. April 2010. Internet website: http://www.nsbdc.org/what/data_statistics/demographer/pubs/docs/2006_ASRHO_Summary.pdf. Accessed September 2010.

_____. 1997. Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II). Second Edition U.S. Department of Commerce. Washington, D.C.

Bureau of Land Management (BLM). 2012. Bureau of Land Management data transmittals to AECOM in Support of the Draft EIS. January 2012 – May 2012.

_____. 2011a. BLM data transmittals to AECOM in support of the Draft EIS. January 2011 through December 2011.

_____. 2011b. GIS Shapefiles for Elko BLM District Fire Data and Big Game Habitat. Email to A. Doud, AECOM from B. Piper, BLM. November 8, 2011.

_____. 2010a. South Operations Area Project Amendment Cumulative Effects, Final Supplemental Environmental Impact Statement. BLM, Elko District Office, Elko, Nevada. April 2010.

_____. 2010b. Leeville Project, Final Supplemental Environmental Impact Statement. BLM, Elko District Office, Elko, Nevada. March 2010.

_____. 2010c. Bureau of Land Management data transmittals to AECOM in Support of the Draft EIS. May 2010 – December 2010.

_____. 2010d. Paleontology Laws Omnibus Public Land Management Act-Paleontological Resources Preservation. Internet website: http://www.blm.gov/wo/st/en/prog/ more/CRM/paleontology/ paleontological_laws.print.html. Site updated February 22, 2001. Accessed March 1, 2010.

_____. 2010e. Nevada BLM Wilderness Study Areas (web page). Nevada State Office. Carson City, Nevada. Internet website: www.blm.gov/nv/st/en/prog/blm_special_ areas/wsas0.html. Accessed August 24, 2010.

_____. 2010f. Geocommunicator NILS – National Integrated Land System. Internet website: http://www.geocommunicator.gov/GeoComm. Accessed May 2010 to December 2010.

_____. 2010g. Land and Mineral Legacy Rehost 2000 System – LR2000. U.S. Department of the Interior. Washington, D.C. Internet website: www.blm.gov/lr2000/ index.htm. Accessed June 25, 2010.

_____. 2010h. Final Public Scoping Comment Summary Report for the Arturo Mine Project, Environmental Impact Statement. BLM, Elko District Office, Tuscarora Field Office, Nevada. November 2010.

_____. 2010i. Email Correspondence with R. Daggett, AECOM and R. Miller, Hydrologist, BLM. Elko Field Office, Elko, Nevada. August 4, 2010.

_____. 2010j. Email Correspondence with S. Duncan, AECOM and J. Stadelman, BLM, Tuscarora, Nevada Field Office. February 4, 2010.

_____. 2009. Betze Pit Expansion Project, Final Supplemental Environmental Impact Statement. BLM, Elko District Office, Elko, Nevada. March 2009.

_____. 2008a. National Environmental Policy Act Program. Environmental Policy Handbook H-1790-1. Office of the Assistant Director, Renewable Resources and Planning (W200); 1849 C Street NW; Mail Stop 1050LS; Washington, D.C. 20240. January 2008.

_____. 2008b. Betze Pit Expansion Project, Draft Supplemental Environmental Impact Statement. BLM, Elko District Office, Elko Nevada. August 22, 2008.

_____. 2008c. Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management Rawlins Field Office, Rawlins, Wyoming, January 2008. Internet website: http://www.blm.gov/wy/st/en/programs/Planning/rmps/rawlins/feis_prmp.html. Accessed March 1, 2010.

_____. 2007a. South Operations Area Project Amendment Cumulative Effects, Draft Supplemental Environmental Impact Statement. BLM, Elko District Office, Nevada. August 2007.

_____. 2007b. Leeville Project, Draft Supplemental Environmental Impact Statement. BLM, Elko District Office, Nevada. August 2007.

_____. 2007c. Instruction Memorandum No. 2008-009, October 15, 2007. Internet website: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-009.html. Accessed March 1, 2010.

_____. 2007d. Cortez Hills Expansion Project, Draft Environmental Impact Statement. BLM, Battle Mountain Field Office, Battle Mountain, Nevada. July 2007.

_____. 2004a. Hollister Development Block Project Environmental Assessment. Elko Field Office. BLM/EK/PL-2004/002. Elko, Nevada. March 2004.

_____. 2004b. Record of Decision and Resource Management Plan for the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area and Associated Wilderness and Other Contiguous Lands in Nevada. Winnemucca Field Office, Winnemucca, Nevada, and Surprise Field Office, Cedarville, California. July 2004.

_____. 2004c. Surveying for Pygmy Rabbits (*Brachylagus idahoensis*), Fourth Draft. June 3, 2004. 25 pp.

_____. 2003a. Betze Project, Final Supplemental Environmental Impact Statement. Barrick Goldstrike Mines Inc. Summary: Water Resources and Geochemistry. BLM, Elko Field Office, Elko, Nevada. January 2003.

_____. 2003b. Migratory Bird Best Management Practices of the Sagebrush Biome. September 24, 2003.

_____. 2002a. Leeville Project, Draft Environmental Impact Statement. BLM, Elko District Office, Elko, Nevada. March 2002.

_____. 2002b. Phoenix Project, Final Environmental Impact Statement. BLM, Battle Mountain Field Office, Battle Mountain, Nevada. January 2002.

_____. 2001. The Federal Land Policy Management Act of 1976, as amended. U.S. Department of the Interior, Bureau of Land Management Office of Public Affairs, Washington. D.C. 69 pp.

_____. 2000a. Finding of No Significant Impact and Preliminary Programmatic Environmental Assessment for: Selected Actions for Mining Claim and Millsite Use and Occupancy in Nevada. U.S. Department of the Interior, Bureau of Land Management, Nevada State Office. March 2000.

_____. 2000b. Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project. BLM, Elko District Office, Elko, Nevada. April 2000.

_____. 2000c. Betze Project, Draft Supplemental Environmental Impact Statement. BLM, Elko Field Office, Nevada. September 2000.

_____. 2000d. South Pipeline Project, Final Environmental Impact Statement. BLM, Battle Mountain Field Office. Battle Mountain, Nevada. February 25, 2000.

_____. 1997. Decision of Record, Dee Gold Mine Expansion Project III, Environmental Assessment BLM/EK/PL-97/003, N16-83-005P. October 1997.

_____. 1996a. Round Mountain Mill and Tailings Facility, Final Environmental Impact Statement. BLM, Battle Mountain District Office, Battle Mountain, Nevada. February 1996.

_____. 1996b. Newmont Gold Bootstrap Project, Draft Environmental Impact Statement. BLM, Elko Field Office, Elko, Nevada.

_____. 1993. Dee Gold Mine Expansion Project, Environmental Assessment (EA-NV-010-91-101). BLM, Elko Field Office, Elko, Nevada. File: N16-83-005P.

_____. 1991a. Betze Project, Draft Environmental Impact Statement. Barrick Goldstrike Mines Inc. BLM, Elko District Office, Elko, Nevada. January 1991.

_____. 1991b. Betze Project, Final Environmental Impact Statement. Barrick Goldstrike Mines Inc. BLM, Elko District Office, Elko, Nevada. June 1991.

_____. 1991c. Nevada BLM Statewide Wilderness Report. Nevada State Office. Carson City, Nevada. October 1991. Internet website: www.nv.blm.gov/wilderness/ default.htm. Accessed August 2010.

_____. 1987. Elko Resource Management Plan Record of Decision. U.S. Department of the Interior. BLM Elko Field Office, Elko, Nevada. March 1987.

_____. 1986. Final Elko Proposed Resource Management Plan and Final Environmental Impact Statement: Elko Resource Area, Elko District. Elko, Nevada.

_____. 1984. Visual Resource Management Manual 8400 series. Department of the Interior, Bureau of Land Management. Visual Resource Inventory Manual (1986), Visual Contrast Rating manual (1986), Visual Resource Management Classifications (1986). Internet website: http://www.blm.gov/nstc/VRM/8400.html. Accessed December 10, 2010.

Bureau of Reclamation. 2011. Technical Memorandum 86-68210-2010-03. Literature Synthesis on Climate Change Implications for Water and Environmental Resources. Second Edition. Prepared by Technical Service Center, Water Resources Planning and Operations Support Group, Water and Environmental Resources Division. Authors: Mark Spears, Alan Harrison, V. Sankovich, J. Soddell, and L. Brekke. U.S. Department of the Interior, Bureau of Reclamation, Research and Development Office, Denver, Colorado.

Cedar Creek Associates, Inc. (Cedar Creek). 2009. Wetlands Delineation for the Dee Project. Prepared for SRK Consulting, Inc. September 2008, revised January 2009. 37 pp.

Christensen, J. H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R. K. Kolli, W. T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C. G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton. 2007. Regional Climate Projections. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Editors. Cambridge University Press, Cambridge, United Kingdom and New York, New York, USA.

Cole, E. K., M. D. Pope, and R. G. Anthony. 1997. Effects of Road Management on Movement and Survival of Roosevelt Elk. Journal of Wildlife Management 61(4):1115-1126.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to Manage Sage-grouse Populations and their Habitats. Wildlife Society Bulletin 28(4):967-985.

Cope, E., R. Hipsley, P. Dobak, D. Arbonies, and S. Brower. 2008. South Arturo: A Recent Gold Discovery on the Carlin Trend, Mining Engineering. January 2008.

Council on Environmental Quality (CEQ). 2010. February 18, 2010 Memorandum for Head of Federal Departments and Agencies from : N. H. Sutley, Chair, Council on Environmental Quality Subject: Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions.

_____. 1997. Environmental Justice: Guidance under the National Environmental Policy Act. Executive Office of the President. December 10, 1997.

D'Antonio, C. M., J. M. Levine, and M. Thomsen. 2001. Ecosystem Resistance to Invasion and the Role of Propagule Supply: A California Perspective. Journal of Mediterranean Ecology 2, 233-245.

Dee Gold Mining Company. 1997. Project Description Overview. Published by Dee Gold Mining Company and Cordex Exploration Company.

Dobak, P. J., D. Arbonies, R. Hipsley, and M. Visher. 2002. Geology of the Storm Gold Deposit. In Teal, L., and R. O. Meeuweg, (eds), 2002, Gold Deposits of the Carlin Trend. Nevada Bureau of Mines and Geology Bulletin No. 111.

Dobra, J. 1988. The Economic Impacts of Nevada's Mineral Industry Nevada Bureau of Mines and Geology, Special Publication L-9. University of Nevada-Reno, Mackay School of Mines. Reno, Nevada.

_____. 1989. The economic Impacts of Nevada's Mineral Industry: 1988 Update. Nevada Bureau of Mines and Geology, Special Publication L-9. University of Nevada-Reno, Mackay School of Mines. Reno, Nevada.

Elko County Nevada. 2010. Elko County Public Land Use and Natural Resource Management Plan, 2010. Elko County Board of Commissioners and Elko County Natural Resource Management Advisory Commission. Elko, Nevada.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Enviroscientists, Inc. 2012. 1-Hour NO_2 and SO_2 Modeling Analysis – Barrick/Dee Mining Venture, Dee/Arturo Expansion Project, Elko County, Nevada. Memorandum to S. Schoen, Barrick Gold of North America, Inc. July 12, 2012.

_____. 2011a. Air Quality Impact Assessment Report. Barrick/Dee Mining Venture Dee/Arturo Expansion Project, Elko County, Nevada. Prepared for BLM, Tuscarora Field Office, Elko, Nevada. January 2011.

_____. 2011b. Air Dispersion Modeling Analysis for an Alternative Waste Rock Disposal Facility – Barrick/Dee Mining Venture, Dee/Arturo Expansion Project, Elko County, Nevada. Memorandum to S. Schoen, Barrick Gold of North America, Inc. September 30, 2011.

Erathem-Vanir Geological Consultants. 2010. Paleontological Field Evaluation of the Proposed Hollister Mine Electric Line Corridor, June 22-23, 2010. BLM Report Number BLM 1-2815. August 31, 2010.

Erman, N. 2002. Lessons from a Long-term Study of Springs and Spring Invertebrates (Sierra Nevada, California, U.S.A) and Implications for Conservation and Management. Conference Proceedings, Spring-fed Wetlands: Important Scientific and Cultural Resources of the Intermountain Region.

Fawcett, B. 2010. Email correspondence with K. Munson (AECOM). November 22, 2010.

Federal Emergency Management Agency (FEMA). 2010. Current and historic FEMA-issued flood maps for Elko and Eureka counties, Nevada. Internet websites: http://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?catalogId=10001&storeId=10001&categoryId=12001&langId=-1&userType=G&type=1&future=false *and* http://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?catalogId=10001&storeId=10001&categoryId=12010&langId=-1&userType=G&type=9&dfirmCatId=12009. Accessed June 3, 2010.

Fenneman, N. 1931. Physiography of the Western United States, McGraw-Hill. New York, 1931.

Fitzgerald, W. F., R. P. Mason, and G. M. Vandall. 1991. As Cited In: D. B. Porcella. 1994. Mercury in the Environment: Mercury Pollution Integration and Synthesis. C. J. Watras and J. W. Huckabee, Editors. Lewis Publishers 1994.

Floyd, T., C. S. Elphick, G. Chisholm, K. Mack, R. G. Elston, E. M. Ammon, and J. D. Boone. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press. 581 pp.

Gelbard, J. L. and J. Belnap. 2003. Roads as Conduits for Exotic Plant Invasions in a Semiarid Landscape. Conservation Biology 17(2): 420-432.

Geomega. 2011. Arturo Pit Lakes Bootstrap Formation Attenuation Tests for Antimony, Arsenic, Manganese, Nickel, Selenium, and Thallium. Prepared for Barrick Goldstrike Mines Inc. September 22, 2011.

Gilbert, M. and P. Thomas, D. L. Jenkins, A. Gotherstrom, N. Naveran, J. J. Sanchez, M. Hofreiter, P. F. Thomsen, J. Binladen, T. F. G. Higham, R. M. Yohe II, R. Parr, L.S. Cummings, and E. Willerslev. 2008. DNA from Pre-Clovis Human Coprolites in Oregon, North America. *Science* 320(5877): 786-789.

Glamis Dee Gold Mine. 2001. Water Pollution Control Permit Renewal Application. January 2001.

Granger, A. E. and M. M Bell, G. Simmons, and F. Lee. 1957. Geology and Mineral Resources of Elko County, Nevada. Nevada Bureau of Mines and Geology, Bulletin 54.

Great Basin College (GBC). 2008. Website of Great Basin College. Internet website: http://www.gbcnv.edu/index.html. Accessed March 11, 2008.

Great Basin Ecology. 2011. Memo to J. Spiegel, Barrick Gold of North America from G. Back, Great Basin Ecology, Inc. September 14, 2011.

_____. 2009. Barrick Dee Project Baseline Survey. Prepared for SRK Consulting, Inc. December 2008 – revised January 2009. 15 pp.

_____. 2008. Dee Gold Mine 2008 Reclamation Vegetation Monitoring, Elko County, Nevada. Prepared for Marigold Mining Company Dee Gold Mine. September 2008.

Hansen, J., R. Ruedy, M. Sato, and K. Lo. 2010. Global Surface Temperature Changes. Reviews of Geophysics, 48, RG4004. DOI:10.1029/2010RG000345.

Harris, C. M. 1979. Handbook of Noise Control, 2nd Ed. McGraw-Hill Book Company. New York, New York. 1979.

Harvey, M. J., J. S. Altenbach, and T. L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission. 62 pp.

Herron, G. B., C. A. Mortimore, and M. S. Rawlings. 1985. Nevada Raptors: Their Biology and Management. Nevada Department of Wildlife. Biological Bulletin No. 8. 114 pp.

Hockett, B. 2010. BLM, Wells, Nevada Field Office Archaeologist; Personal communication with J. Stadelman, BLM, Tuscarora Nevada Field Office. February 4, 2010.

Holloran, M. J. 2005. Greater Sage-grouse (*Centrocercus urophasianus*) Population Response to Natural Gas Field Development in Western Wyoming. PhD Dissertation. University of Wyoming. Laramie, Wyoming. 211 pp.

Hydrologic Consultants, Inc. 1999. Numerical Ground Water Flow Modeling, South Operations Area Project Amendment, Eureka County, Nevada, Prepared for Newmont Gold Company.

Intergovernmental Panel on Climate Change (IPCC). 2011. Summary for Policymakers. In: Intergovernmental Panel on Climate Change Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C. B., Barros, V., Stocker, T.F., Qin, D., Dokken, D., Ebi, K.L., Mastrandrea, M. D., Mach, K. J., Plattner, G.-K., Allen,S. K., Tignor, M. and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

_____. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contributions of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Irwin, L. L. and J. M. Peek. 1983. Elk Habitat Use Relative to Forest Succession in Idaho. Journal of Wildlife Management 47(3):664-672.

JBR Environmental Consultants, Inc. (JBR). 2012. Bootstrap Haul Road Widening Project, Findings of Boulder Creek Inspection. Memo to J. Spiegel, Barrick Gold North America from N. Kang, JBR. May 3, 2012.

_____. 2009. Dee Arturo Project, Jurisdictional Waters Review, Elko County, Nevada. Prepared for Barrick Gold of North America, Elko, Nevada. Prepared by JBR Environmental Consultants, Inc., Reno, Nevada. November 2009.

_____. 1993. Wildlife and Aquatic Resources Little Boulder Basin. Prepared for Barrick Goldstrike Mines Inc. Elko, Nevada.

_____. 1988. Little Boulder Basin. Report Prepared for Newmont Gold Company, Carlin, Nevada. Nevada Department of Wildlife. 1975. Field Trip Report, Boulder Creek. Unpublished File Report.

John Shomaker & Associates, Inc. (JSA). 2011. Memorandum: Hydraulic effects of partially backfilling the Arturo pit, Barrick Gold-South Arturo Project, October 4, 2011.

_____. 2010a. Memorandum: Summary of Changes to the Barrick Goldstrike Regional Hydrologic Model. August 25, 2010.

_____. 2010b. Technical Memorandum: Projected Water Levels and Water Balance of the Arturo Pit. June 8, 2010.

_____. 2010c. Technical Memorandum: Projected Water Levels and Water Balance of the Existing Dee Pit. July 8, 2010.

_____. 2010d. Technical Memorandum: Tracking Projected Movement of Groundwater Infiltration from the Arturo Pit. March 16, 2010.

Johnsgard, P. A. 1990. Hawks, Eagles, and Falcons of North America. Smithsonian Institution Press. 403 pp.

Jory, J. 2002. Stratigraphy and Host Rock Controls of Gold Deposits of the Northern Carlin Trend in Bureau of Mines and Geology Bulletin 111 – Gold Deposits of the Carlin Trend.

Korb, J. E., N. C. Johnson, and W. W. Covington. 2004. Slash Pile Burning Effects on Soil Biotic and Chemical Properties and Plant Establishment: Recommendations for Amelioration. Restoration Ecology 12(1):52-62.

Laybourn, D. 2012. Newmont Mining Corporation, TS Power Plant, Environmental Manager. Personal communication with P. Plumley, Consulting Hydrogeologist regarding the water supply for the TS Power Plant. April 24, 2012.

Lyon, A. G. and S. H. Anderson. 2003. Potential Gas Development Impacts on Sage-grouse Nest Initiation and Movement. Wildlife Society Bulletin 31(2):486-491.

Lyon, L. J. 1983. Road Density Models Describing Habitat Effectiveness of Elk. Journal of Forestry 81:592-595.

_____. 1979. Habitat Effectiveness for Elk as Influenced by Roads and Cover. Journal of Forestry, October 1979, pp. 658-660.

Massman, W. J., J. M. Frank, W. D. Sheppard, and M. J. Platten. 2003. In Situ Soil Temperature and Heat Flux Measurements During Controlled Burns at a Southern Colorado Forest Site. Fire, Fuel Treatments, and Ecological Restoration: USDA Forest Service Proceedings. April 16-18 2002. Rocky Mountain Research Station, RMRS-P-29. Fort Collins, Colorado.

Maurer, D. K., R. W. Plume, J. M. Thomas, and A. K. Johnson. 1996. Water Resources and Effects of Changes in Ground-Water Use Along the Carlin Trend, North-Central Nevada. U.S. Geological Survey Water-Resources Investigations Report 96-4134. Nevada Division of Water Resources, USDI. Carson City, Nevada.

McClelland Laboratories, Inc. 2010. Report on Special Protocol Environmental Characterization Tests and Analyses - Various Solids Materials from the Dee/Arturo Project. Prepared for Barrick Gold Exploration, Inc., Elko, Nevada. McClelland Laboratories, Inc., Sparks, Nevada. June 20, 2010.

McDonald Morrissey Associates, Inc. (MMA). 1998. Regional Hydrologic Model, Barrick Goldstrike Mines, Inc. Elko and Eureka Counties, Nevada. Reston, Virginia. February 24, 1998.

_____. 1996a. Conceptual Groundwater Flow System, Barrick Goldstrike Mines, Inc., Elko and Eureka Counties, Nevada. Reston, Virginia. October 11, 1996.

_____. 1996b. Goldstrike Hydrologic Model, Barrick Goldstrike Mines, Inc., Elko and Eureka Counties, Nevada. Reston, Virginia. October 11, 1996.

Miller, K. 2011. Eastern Region Mining Biologist, NDOW. Elko, Nevada. Personal communication with B. Strom, AECOM. January 2011.

_____. 2010. Eastern Regional Mining Biologist, NDOW. Email Correspondence with M. Brekke, AECOM, Colorado. March 2, 2010.

_____. 2009. Eastern Region Mining Biologist, NDOW. Email Correspondence with M. Brekke, AECOM. December 8, 2009.

Moore, S. 2002. Geology of the Northern Carlin Trend in T. B. Thompson, R.J. Roberts, L. Teal, and R. O. Meeuwig, Editors. Gold Deposits of the Carlin Trend. Nevada Bureau of Mines and Geology Bulletin 111. Internet website: http://www.nbmg.unr.edu/dox/b111/b111.htm. Accessed May 21, 2010.

National Wildfire Coordinating Group. 2001. Fire Effects Guide. National Interagency Fire Center, Great Basin Area Cache, Boise ID. Internet URL: http://www.nwcg.gov/pms/RxFire/FEG.pdf. Accessed January 9, 2012.

NatureServe Explorer. 2010. Northern Leopard Frog (*Rana pipiens*). Internet website: http://www.natureserve.org/explorer/. Accessed July 2, 2010.

Neel, L. A. 1999. Nevada Partners in Flight Bird Conservation Plan. Internet website: http://www.blm.gov/wildlife/plan/pl-nv-10.pdf. Accessed February 18, 2010.

Nevada Administrative Code (NAC). 2012. NAC 445B.22097 Standards of Quality for Ambient Air (NRS 445B.210). Internet website: http://ndep.nv.gov/baqp/monitoring/docs/445b391.pdf. Accessed January 18, 2012.

Nevada Department of Agriculture. 2006. Nevada Department of Agriculture. Nevada Department of Agriculture Plant Industry Division. Noxious Weed List. Copyright 2005 Department of Agriculture. Internet website: http://agri.nv.gov/nwac/PLANT_NoxWeedList.htm. Updated June 10, 2010. Accessed November 2010.

Nevada Department of Education. 2010a. Student Enrollment and Licensed Personnel Information. Research Bulletin Volume 50. Carson City, Nevada. February 2010. Internet website: http://nde.doe.nv.gov/Resources/Bulletin-FY2010.pdf. Accessed December 2010.

_____. 2010b. 2008-2009 Count Day Enrollment Report. Administrative and Fiscal Services. Carson City, Nevada. Internet website: http://nde.doe.nv.gov/Resources/2008-2009EnrollmentBySchool.pdf. Accessed December 2010.

_____. 2009. Student Enrollment and Licensed Personnel Information. Research Bulletin Volume 50. Carson City, Nevada. February 2009. Internet website: http://nde.doe.nv.gov/Resources/Bulletin-FY2009.pdf. Accessed December 2010.

Nevada Department of Employment, Training, and Rehabilitation (NDETR). 2010a. Nevada Workforce Informer: 2009 Nevada Occupational Employment & Wages (OES). Research and Analysis Bureau. Carson City, Nevada. Internet website: www.nevadaworkforce.com/cgi/dataAnalysis/oesWageReport.asp. Accessed December 2010.

_____. 2010b. Nevada Workforce Informer. Research and Analysis Bureau. Carson City, Nevada. Internet website: www.nevadaworkforce.com/cgi/dataAnalysis/LabForceReport.asp. Accessed December 2010.

_____. 2009. Nevada Employment and Payrolls 2008. Research and Analysis Bureau. Carson City, Nevada. Internet website: www.nevadaworkforce.com/admin/uploadedPublications/2758_2008_E_and_P_web.pdf. Accessed December 2010.

Nevada Department of Taxation. 2010a. Final Budget Forms S-1 and S-2 for Fiscal Year 2009-2010 for Elko County. Eureka County, the City of Carlin and the City of Elko. State of Nevada. Carson City, Nevada.

_____. 2010b. Annual Report: Fiscal Year 2008-2009. Carson City, Nevada. January 15, 2010. Internet website: http://tax.state.nv.us/documents/AnnualReport_ FY09_final.pdf. Accessed December 2010.

Nevada Department of Transportation (NDOT). 2009. 2009 Annual Traffic Report. Traffic Information Division. Carson City, Nevada. Internet website: www.nevadadot.com/reports_pubs/traffic_report/2009/. Accessed December 2010.

Nevada Department of Wildlife (NDOW). 2012. Greater Sage-grouse Habitat Categorization Map. Internet website: http://ndow.org/wild/conservation/sg/index.shtm. Accessed March 28, 2012.

_____. 2011. Nevada Department of Wildlife 2010-2011 Big Game Status. June 2011. 130 pp.

_____. 2010a. GIS Shapefiles. Internet website: http://gis.ndow.nv.gov. Accessed July 9, 2010.

_____. 2010b. Scoping Letter from K. Miller, NDOW to J. Daniel, BLM Project Manager Regarding The Arturo Mine Project. July 8, 2010.

_____. 2010c. Nevada Department of Wildlife 2009-2010 Big Game Status. June 2010. 114 pp.

_____. 2009. Nevada Department of Wildlife Upland and Migratory Game Bird, Rabbit and Furbearing Mammals: Harvest Data and Population Status Reports. June 2009. 99 pp.

_____. 1975. Inventory of Boulder Creek. Field Trip Report, D. Erickson, June 6, 1975.

Nevada Division of Environmental Protection (NDEP). 2010. NDEP Bureau of Mining and Regulation and Reclamation, Closure Branch web site. http://ndep.nv.gov/bmrr/clshome.html. Accessed on July 21, 2010.

_____. 2008. Nevada Statewide Greenhouse Gas Emissions Inventory and Projection, 1990-2020. Updated December 2008.

Nevada Division of State Lands. 1986. Nevada Summary Policy Plan for Public Lands. Internet website: http://land.nv.gov/policies/chapter1.htm. Accessed February 9, 2011.

Nevada Division of Water Resources (NDWR). 2010a. Designated Groundwater Basins of Nevada (1:750,000 scale map of April 2010) and pertinent county hydrographic basin listings. Nevada Department of Conservation and Natural Resources, Office of the State Engineer, Division of Water Resources. Carson City, Nevada. Internet website: http://water.nv.gov/WaterPlanning/cty-bsn/cty_map.cfm. Accessed August 7, 2010.

_____. 2010b. Water Rights Database. Internet website: http://water.nv.gov/Water%20Rights/permitdb/permitdb_index.cfm?CFID=1074727&CFTOKEN=96536164. Accessed August 2010.

Nevada Natural Heritage Program (NNHP). 2010a. Animal and Plant At-Risk Track List. September 2009. Internet website: http://heritage.nv.gov/lists/track.pdf. Accessed July 9, 2010.

_____. 2010b. Response to Request for Information Letter from E. Miskow, Biologist III/Data Manager, NNHP to M. Brekke, AECOM. July 22, 2010.

Nevada State Fire Marshal and State Emergency Response Commission. 2008. Hazardous Material Inventory Reporting and Permitting Requirements. Internet website: http://fire.state.nv.us/Hazmat%20Reporting%20and%20Requirements%20Page.shtml. Accessed May 20, 2010.

Norby, J. W. 2002. Geology of the Maggie Creek District Carlin Trend, Eureka County, Nevada. In: T. B. Thompson, R. J. Roberts, L. Teal, and R. O. Meeuwig, Editors. Gold Deposits of the Carlin Trend. Nevada Bureau of Mines and Geology Bulletin 111. Internet website: http://www.nbmg.unr.edu/dox/b111/b111.htm. Accessed May 21, 2010.

Northeast Nevada Regional Hospital (NNRH). 2010. Website. Elko, Nevada. Internet website: http://www.nnrhospital.com/facility.shtml. Accessed December 2010.

Northeastern Nevada Stewardship Group, Inc. 2003. Draft Elko County Sagebrush Ecosystem Conservation Strategy, December 2003. 118 pp. Northeastern Nevada Stewardship Group, Inc., Elko, Nevada.

O'Farrell, M. J. and A. R. Blaustein. 1974. *Microdipodops megacephalus*. Mammalian Species. No. 46:1-3.

Parkhurst, D. L. and C. A. J. Appelo. 1999. User's Guide to PHREEQC (Version 2) – A Computer Program for Speciation, Batch-Reaction, One-dimensional Transport, and Inverse Geochemical calculations. Water-Resources Investigations Report 99-4259. U.S. Geological Survey. U.S. Government Printing Office, Washington, D.C.

Pierce-Fitzgerald, P. 2010. CAD Operator/ROW Permit Technician, Elko County Planning and Zoning and Natural Resources Division. Elko, Nevada. Personal communication with B. Strom, AECOM. June 29, 2010.

Pierson, F., C. Williams, P. Kormos, and O. Al-Hamdan. 2011. Runoff and erosion responses on burned and unburned sagebrush steppe and wooded shrublands in the Great Basin, USA. Meeting abstract at http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=270871. Accessed November 14, 2011. USDA-Agric. Research Service, Northwest Watershed Research Center, Boise, Idaho.

Pierson, F., P. Robichaud, and K. Spaeth. 2003. Hydrologic recovery of steep sagebrush rangeland following wildfire. Research abstract submitted to Abstracts, Society for Range Management, http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=153418. Published February 6, 2003, accessed November 14, 2011. USDA-Agricultural Research Service, Northwest Watershed Research Center, Boise, Idaho.

Piteau Associates. 2011. Arturo Project – Review of the X11P7J Mine Plan for the North Deep, South Arturo, Hinge and West Button Hill Pits. Memorandum from Michael Scholz and Nick Rose Piteau Associates to Ken Morgan Barrick Gold of North America. June 22, 2011.

_____. 2010. Arturo Project – Recommended Feasibly Open Pit Slope Design Criteria for the Hinge and West Button Hill Pits – 825 Mine Plan. April 20, 2010.

_____. 2008. Recommended Feasibility Open Pit Slope Designs for the Arturo Project. April 17, 2008. Revised March 8, 2010.

Plume, R. 1995. Water Resources and Potential Effects of Ground-Water Development in Maggie, Marys, and Susie Creek Basins, Elko and Eureka Counties, Nevada. U.S. Geological Survey Water-Resources Investigations Report 94-4222. Prepared in cooperation with the Nevada Division of Water Resources. U.S. Geological Survey, Carson City, Nevada.

Porcella, D. B. 1994. Mercury Pollution Integration and Synthesis. Mercury in the Environment: Biogeochemistry. C. J. Watras and J. W. Huckabee, Editors. Lewis Publishers 1994.

Ports, M. A. and S. B. George. 1990. *Sorex preblei* in the Northern Great Basin. Great Basin Naturalist 50(1):93-95.

Price, S. and T. Harris. 2007. An Analysis of the Economic Impacts of the Hard Rock Mining Sector on the Elko Metropolitan Statistical Area (Technical Report: UCED 2007/08-03). University Center for Economic Development, Department of Resource Economics, University of Nevada, Reno. Reno, Nevada. September 2007.

Prudic, D. E., Harrill, J. R., and T. J. Burbey. 1995. Conceptual Evaluation of Regional Ground-water Flow in the Carbonate-Rock Province of the Great Basin, Nevada, Utah, and Adjacent States. U.S. Geological Survey Professional Paper 1409-D. U.S. Government Printing Office, Washington, D.C.

Prudic, D. E., R. G. Niswonger, and R. W. Plume. 2006. Trends in Streamflow in the Humboldt River between Elko and Imlay, Nevada, 1950-1999. U.S. Geological Survey Scientific Investigations Report 2005-5199. U.S. Geological Survey, Information Services, Denver, Colorado.

Radian International, LLC and Baker Consultants, Inc. 1997. Hydrogeochemical Conceptual Model Betze-Screamer Pit Lake Modeling Project. Salt Lake City, Utah.

Rawlings, M. S. and L. A. Neel. 1989. Wildlife and Wildlife Habitats Associated with the Humboldt River and its Major Tributaries. Nevada Department of Wildlife. Biological Bulletin No. 10. 66 pp.

Resource Concepts, Inc. 2001. Executive Summary, Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada. Prepared for the State of Nevada Department of Agriculture and the Nevada Association of Counties. March 26, 2001. 17 pp. Resource Concepts, Inc. Carson City, Nevada.

Rost, G. R. and J. A. Bailey. 1979. Distribution of Mule Deer and Elk in Relation to Roads. Journal of Wildlife Management 43(3):634-641.

Sawyer H., R. M. Nielson, F. Lindzey, and L. L. McDonald. 2006. Winter Habitat Selection of Mule Deer Before and During Development of a Natural Gas Field. Journal of Wildlife Management 70(2):396-403.

Sawyer, H., F. Lindzey, and D. McWhirter. 2005. Mule Deer and Pronghorn Migration in Western Wyoming. Wildlife Society Bulletin 33(4):1266-1273.

Schafer Limited LLC (Schafer). 2012a. Dee Arturo Pit Lake Water Quality Prediction. Submitted to Barrick Exploration and Goldcorp Inc. Revised January 2012.

_____. 2012b. Responses to Comments on Arturo Pit Lake Study. Submitted to J. Spiegel, Barrick Gold North America, Arturo Project. January 5, 2012.

_____. 2011a. Arturo Waste Rock Characterization. Memo to G. Goodrich, Barrick Goldstrike Mines Inc. from W. M. Schafer, Schafer Limited LLC. August 29, 2011.

_____. 2011b. Groundwater Fate and Transport – Arturo Pit Lake Study. Submitted to Gary Goodrich, Barrick Goldstrike Mines Inc., Arturo Project. September 11, 2011.

_____. 2011c. Response to Comments on the Arturo Pit Lake Study. Submitted to J. Spiegel, Barrick Gold North America, Arturo Project. December 14, 2011.

_____. 2011d. Effects of Partial Backfill on Arturo Water Quality. Submitted to Gary Goodrich, Barrick Goldstrike Mines Inc., Arturo Project. October 22, 2011.

Schroedl, A. R. and D. E. Tallman. 1997. *Surface Collection, Mapping, and Testing of Site 26EK5278, Eureka County, Nevada*. Prepared by P-III Associates, Inc., Salt Lake City, Utah. On file at the BLM, Elko, Nevada. BLM 1-2448.

Science Daily. 2011. Cooling the Warming Debate: Major New Analysis Confirms That Global Warming is Real. October 21, 2011.

Sergent, Hauskins & Beckwith Consulting Engineers. 1991. Geotechnical Investigation and Design Report, Heap Leach Facility, Elko County, Nevada. June 28, 1991.

SRK Consulting (U.S.), Inc. (SRK). 2012. Email correspondence and data transmittal to S. Mackinnon, AECOM from L. Boyer, SRK. January 24, 2012.

_____. 2011. Arturo Mine – Permitting-Level Stormwater Design for the Environmental Impact Statement. Letter to K. Morgan, Barrick Gold of North America, from SRK Consulting (U.S.), Inc. July 28, 2011.

_____. 2010a. Letter and attachments of July 15, 2010, from D. P. Neuffer, P.E., to S. Brower, Project Manager, Arturo Project, Barrick Gold Exploration, Inc, Elko, Nevada, presenting preliminary storm water design for the Arturo Mine. SRK Consulting (U.S.), Inc., Elko, Nevada.

_____. 2010b. Memorandum of July 14, 2010, from C. Schultz of SRK to S. Brower of Barrick Gold Corporation, summarizing results of the quarterly water quality sampling program at the Arturo/Dee surface water monitoring sites. SRK Consulting (U.S.), Inc., Elko Nevada. 6 pp.

_____. 2009a. Plan of Operations and Reclamation Permit Application, Dee Arturo Expansion Project. Prepared for Barrick-Dee Mining Venture, Elko, Nevada. Prepared by SRK Consulting (U.S.), Inc., Elko, Nevada. June 2009.

_____. 2009b. Dee Arturo Project Biological Baseline Supplemental Report. Prepared for Barrick Gold Inc. October 2009. 14 pp.

_____. 2009c. Barrick Dee Project Baseline Survey. Prepared for SRK Consulting, Inc. December 2008, revised January 2009. 15 pp.

Stewart, J. H. 1980. Geology of Nevada, A Discussion to Accompany the Geologic Map of Nevada. Nevada Bureau of Mines and Geology Special Publication 4, 136 pp.

Stewart, J. H. and E. H. McKee. 1977. Geology and Mineral Deposits of Lander County, Nevada, Part 1, Geology. Nevada Bureau of Mines and Geology Bulletin 88, 106 pp. Mackay School of Mines, University of Nevada, Reno.

SWCA Environmental Consultants (SWCA). 2011. Class I Cultural Resources Inventory for the Barrick Gold Exploration Arturo Project, Elko and Eureka Counties, Nevada. SWCA Environmental Consultants, Salt Lake City, Utah. BLM1-2767. Addendum on file at BLM, Elko, Nevada.

_____. 2010a. Treatment Plan for Prehistoric Archaeological Sites in the Dee Arturo Project Area, Elko County, Nevada. SWCA Environmental Consultants, Salt Lake City, Utah. BLM 1-2811. On file at BLM, Elko, Nevada.

_____. 2010b. Site summary tables sent to K. Munson, AECOM, via email on July 16, 2010.

Teal, L. and M. Jackson. 2002. Geologic Overview of the Carlin Trend Gold Deposits. In: Thompson, T. B., L. Teal, and R. O. Meeuweg, (eds), 2002, Gold Deposits of the Carlin Trend. Nevada Bureau of Mines and Geology Bulletin No. 111.

Telesto Nevada. 2004. Engineering Design Change to Dee Mine Tailings Dam #1 Permanent Outlet for Storm Water Runoff. Prepared for Glamis Gold, Inc., Dee Gold Mine, Reno, Nevada. Prepared by Telesto Nevada LLC, Reno, Nevada, as an addendum to the Final Permanent Closure Plan for Tailings Dam #1 at the Dee Mine. September 2004.

Tetra Tech. 2011a. Barrick Dee Mine Venture WRDF Slope Stability Slope. Technical Memorandum to K. Morgan Barrick Gold Exploration from J. Knudsen Tetra Tech, June 1, 2011.

_____. 2011b. Barrick Dee Mine Venture Project Proposed Heap Leach Pad Slope Stability. Technical Memorandum to S. Schoen, Barrick Gold of North America from J. Knudsen Tetra Tech, August 16, 2011.

_____. 2009. Dee Arturo Project – Slope Stability of West and East Overburden Areas. Technical Memorandum to K. Morgan Barrick Gold Exploration, Inc. from J. Knudsen Tetra Tech, June 24, 2009.

Theodore, T. G., B. C. Moring, T. Chadwick, P. J. Dobac, J. K. Cluer, and R. J. Fleck. 2006. Geology of the Santa Renia Fields Quadrangle, Elko and Eureka Counties, Nevada. Nevada Bureau of Mines and Geology Map 155.

Tiley, S. 2010a. Email correspondence with K. Munson, AECOM. November 3, 2010.

_____. 2010b. Ethnographic Summary Report sent to K. Munson, AECOM. November 8, 2010.

Tingley, J. R. 1998. Mining Districts of Nevada. Nevada Bureau of Mines and Geology. Report 47. Second Edition. Mackay School of Mines, University of Nevada, Reno. 329. pp.

U.S. Army Corps of Engineers (USACE). 2010. Jurisdictional determination letter of August 13, 2010 from J. A. Gipson, Chief of the Nevada-Utah Regulatory Branch, U.S. Army Engineer District, Sacramento, California, to S. Brower, Barrick Gold U.S., Inc., Elko, Nevada. Regulatory Division SPK-2000-25139.

_____. 2006. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region. ERDC/EL TR-06-16, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

U.S. Census Bureau. 2010a. Profile of General Population and Housing Characteristics: 2010 Demographic Profile Data (DP-1. U.S. Department of Commerce. Washington, D.C. Internet website: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

_____. 2010b. Small Area Income and Poverty Estimates for Nevada Counties, 2009. U.S. Department of Commerce. Washington, D.C. Internet website: http://www.census.gov/cgi-bin/saipe/saipe.cgi. Accessed April 2010.

_____. 2009. Small Area Income and Poverty Estimates for Nevada Counties, 2008. U.S. Department of Commerce. Washington, D.C. November 2009. Internet website: www.census.gov/cgi-bin/saipe/saipe.cgi. Accessed December 2010.

_____. 2000. Table DP-1. Profile of General Demographic Characteristics: 2000. U.S. Department of Commerce. Washington, D.C. Internet website: http://factfinder.census.gov/servlet/QTTable?_bm=y&-context=qt&-qr_name=DEC_2000_SF1_U_DP1&-ds_name=DEC_2000_SF1_U&-CONTEXT=qt&-tree_id=4001&-all_geo_types=N&-geo_id=05000US32007&-geo_id=05000US32011&-geo_id=05000US32013&-geo_id=05000US32015&-search_results=01000US&-format=&-_lang=en. Accessed September 9, 2010.

_____. 1980. 1980 Census of Population: Volume 1 Characteristics of the Population: Chapter A Number of Inhabitants: Part 30 Nevada PC80-1-A30. U.S. Department of Commerce. Washington, D.C. October 1981. Internet website: http//www2.census.gov/prod2/decennial/documents/1980a_nvABCD-01.pdf.

U.S. Congress. 1969. National Environmental Policy Act (NEPA) (P.L. 91-190).

U.S. Department of Agricultural-Natural Resources Conservation Service (USDA-NRCS). 2011. Personal communication with P. Novak, State Range Conservationist and J. Alstad, Range Specialist, AECOM. August 2, 2011.

_____. 2010a. Soil Survey Geographic Database for Tuscarora Mountain Area, Nevada, Parts of Elko, Eureka and Lander Counties Internet website: http://soildatamart.nrcs.usda.gov. Accessed July 28, 2010.

_____. 2010b. The Plants Database, National Plant Data Center, Baton Rouge, Louisiana. http://plants.usda.gov. Accessed November 2010.

_____. 2010c. Web Soil Survey Map Unit Descriptions for Nevada, Parts of Elko, Eureka and Lander Counties (Chen-Pie Creek-Ramires Association-Tuscarora Mountains area; Slaven-Ramires association-Tuscarora Mountains area; Susie Creek-Pie Creek association-Tuscarora Mountain). http://websoilsurvey.nrcs.usda.gov/ app/WebSoilSurvey.aspx. Accessed December 2010.

_____. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

_____. 1998. Nevada Annual Precipitation. Map No. 1008412 at 1: 1,190,000 scale. Developed in cooperation with Oregon State University. USDA-NRCS National Cartography and Geospatial Center, Fort Worth, Texas.

U.S. Department of Housing and Urban Development. 1996. The Noise Guidebook. Environmental Planning Division, Office of Environment and Energy. Washington, D.C.

U.S. Department of Transportation (USDOT). 2010a. Federal Motor Carrier Safety Administration. Nevada: Summary of Large Trucks Involved in Crashes 2005-2009. Internet website: http://ai.fmcsa.dot.gov/CrashProfile/st_overview.asp?StCd=NV. Accessed November 15, 2010.

_____. 2010b. Federal Motor Carrier Safety Administration. Crash Statistics Mapping Tool. NV: large Trucks Involved in HM Placard Crashes (Calendar Year 2008). Internet website: http://ai.fmcsa.dot.gov/mapping/CrashStatistics/default_crash.aspx. November 15, 2010.

U.S. Environmental Protection Agency (USEPA). 2012. SCRAM Surface Meteorological Archived Data: 1984-1992. Internet website: http://www.epa.gov/ttn/scram/surfacemetdata.htm. Accessed May 16, 2012.

_____. 2011. Greenhouse Gas Equivalences Calculator. Internet website: http://www.epa.gov/ cleanenergy/energy-resources/calculator.html. Accessed on January 16, 2011.

_____. 2010a. National Ambient Air Quality Standards. Internet website: http://www.epa.gov/air/criteria.html. Accessed November 2010.

_____. 2010b. Office of Air Quality Planning and Standards. Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS. March 2010.

_____. 2008a. Clean Air Act Sec. 176 (c) (1) United States Environmental Protection Agency: Internet website: http://www.epa.gov/ air/loaq_caa.html. Accessed on January 11, 2008.

_____. 2008b. Climate Change – Science: State of Knowledge. Internet website: http://www.epa.gov/climatechange/science/stateofknowledge.html. Accessed on December 1, 2009.

_____. 2006. RCRA Orientation Manual. U.S. Environmental Protection Agency Office of Solid Waste/Communications, Information, and Resources Management Division. EPA 530-R-06-003, March 2006.

_____. 2005. Guideline on Air Quality Models (as revised) 40 CFR 51, Appendix W.

_____. 2004. The Clean Air Act (as amended through Public Law 108-201, February 24, 2004).

_____. 1998a. Guidelines for Ecological Risk Assessment. EPA/630/R095/002F. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, D.C. May 14, 1998.

_____. 1998b. Climate Change and Nevada. United States Environmental Protection Agency. Office of Policy. EPA-236-F-98-0070. September 1998.

_____. 1997a. Mercury Study Report to Congress. EPA-452/R-97-003. Office of Air Quality Planning and Standards and Office of Research and Development. December 1997.

_____. 1997b. Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments. Final. EPA/540/R-97/006. U.S. Environmental Protection Agency.

_____. 1995. Compilation of Air Pollutant Emission Factors: AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 13 Miscellaneous Sources. January 1995.

_____. 1994. Technical Document: Acid Mine Drainage Prediction. EPA530-R-94-036.

_____. 1993. Wildlife Exposure Factors Handbook. Volumes 1 and 2. EPA/600/R-93/187a and b. Office of Research and Development. Washington, D.C. U.S. Environmental Protection Agency.

_____. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9-74-004. Washington, D.C. March 1974.

_____. 1972. Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States. G. C. Holzworth, Division of Meteorology. USEPA Office of Air Programs, Publication No. AP101. January 1972.

_____. 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. PB-206-717. Washington, D.C. December 31, 1971.

U.S. Fish and Wildlife Service (USFWS). 2010a. Response to Request for Information Letter from R. Williams, Field Supervisor, Nevada Fish and Wildlife Office, USFWS to M. Brekke, AECOM, Fort Collins, Colorado. August 12, 2010.

_____. 2010b. Columbia Spotted Frog. Internet website: http://www.fws.gov/nevada/protected_species/amphibians/species/col_spotted_frog.html. Accessed July 2, 2010.

_____. 2008a. Conclusion of Section 7 Consultation for the Little Canyon Project Natural Gas Development Project Proposed by XTO. FWS/R6 ES/ UT 06 F-0309; 6-UT-09-F-003. Memorandum from Utah Field Supervisor, Ecological Services, West Valley City, Utah. December 4, 2008.

_____. 2008b. Birds of Conservation Concern 2008. Nevada Fish and Wildlife Office, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

U.S. Geological Survey (USGS). 2012. Quaternary Fault and Fold Database for the United States. Internet website: http://earthquake.usgs.gov/regional/qfaults. Accessed January 2012.

_____. 2010. U.S. Geological Survey Earthquake Database. Internet website: http://earthquake.usgs.gov/regional/imw. Accessed August 1, 2010.

_____. 2005. USGS National Gap Analysis Program. Southwest Regional GAP Analysis Project – Land Cover Descriptions. RS/GIS Laboratory, College of Natural Resources, Utah State University. Internet website: http://earth.gis.usu.edu/swgap/ legend_desc.html. Accessed June 1, 2010.

_____. 2004. Southwest Regional GAP (SWReGAP) Analysis Project Land Cover Descriptions. Internet website: http://earth.gis.usu.edu/swgap/swgap_legend_desc.pdf. Accessed June 1, 2010.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater Sage-grouse Population Response to Energy Development and Habitat Loss. Journal of Wildlife Management 71(8):2644-2654.

Ward, A. L. 1976. Elk Behavior in Relation to Timber Harvest Operations and Traffic on the Medicine Bow Range in South-central Wyoming. In: Elk-logging-roads. Symposium Proceedings. Editor: S. R. Heib. pp. 32-43. Moscow University of Idaho.

Water Management Consultants, Inc. 1994. Dee Gold Project Hydrologic and Hydrochemical Conditions in the Final Pit and Underground Workings. Prepared for Dee Gold Mining Company, Elko, Nevada. November 1994.

Watkins, R. Z., J. Chen, J. Pickens, and K. D. Brosofske. 2003. Effects of Forest Roads on Understory Plants in a Managed Hardwood Landscape. Conservation Biology 17(2):411-419.

Waugh, C. J. 2011. Framing the Climate Debate: Knowledge Affirmation vs. Risk Mitigation. Massachusetts Institute of Technology. Engineering Systems Division. March 2011.

West, N. E. 1983. Ecosystems of the World 5 – Temperate Deserts and Semi-Deserts, Chapters 11 (Overview of North American Temperate Deserts and Semi-Deserts), 12 (Great Basin-Colorado Plateau Sagebrush Semi-Desert), and 13 (Western Intermountain Sagebrush Steppe). Neil E. West (ed.). Elsevier Scientific Publishing Company, New York, New York.

Westbrooks, R. 1998. Invasive Plants, Changing the Landscape of America: Fact Book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW). Washington, D.C.

Western Cordillera. 2006. An Integrated Petroleum Evaluation of Northeastern Nevada. Internet website: http://www.westerncordillera.com. Site updated September 12, 2006. Accessed March 3, 2010.

Western Regional Climate Center. 2010. Period of Record Monthly Climate Summary: January 1888 to July 2010. Internet website: http://www.wrcc.dri.edu. Accessed December 10, 2010.

Wildlife Action Plan Team. 2006. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno, Nevada. 630 pp. June 23, 2006.

Zhan, G., Shafter, W., Milczarek, M.,Myers, K., Giraudo, J., and Espell, R. 2006. The Evolution of Evaportranspiration Cover Systems at Barrick Goldstrike Mines. Paper was presented at the 2006, 7thICARD, March 26-30, 2006, St. Louis MO. Published by ASMR, 3134 Montavesta Rd., Lexington, Kentucky.

Zouhar, K. 2003. *Bromus tectorum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Internet website: http://www.fs.fed.us/database/feis. Accessed November 22, 2010.

Appendix A

Reclamation Seed Mixes

Table A-1 Proposed Reclamation Seed Mix

Common Name	Scientific Name
Grasses	
Ephraim Crested Wheatgrass	*Agropyron Cristatum var. Ephraim*
Thickspike Wheatgrass	*Agropyron dasystrachyum*
Bluebunch Wheatgrass	*Agropyron spicatum*
Great Basin Wildrye	*Elymus cinereus*
Big Bluegrass	*Poa ampla*
Indian Ricegrass	*Oryzopsis hymenoides*
Sandberg Bluegrass	*Poa secunda*
Forbs	
Blue Flax	*Linum lewisii*
Small Burnet	*Sanguisorba minor*
Forage Kochia	*Kochia prostrata var. Immigrant*
Palmer Penstemon	*Penstemon palmeri*
Western Yarrow	*Achillea millefolium*
Fourwing Saltbush	*Atriplex canescens*
Antelope Bitterbrush	*Purshia tridentate*
Winterfat	*Eurotia lanata*
Wyoming Big Sagebrush	*Artemesia tridentata wyomingensis*

Source: SRK 2009.

Table A-2 BLM Alternative Plant Species for Reclamation Seed Mix[1]

Common Name	Scientific Name
Thickspike wheatgrass	*Agropyron dasystachyum*
Pubescent wheatgrass	*Agropyron trichophorum*
Streambank wheatgrass	*Agropyron riparium*
Bluebunch wheatgrass	*Agropyron spicatum*
Sandberg bluegrass	*Poa secunda*
Indian ricegrass	*Oryzopsis hymenoides*
Webber ricegrass	*Oryzopsis webberi*
Idaho fescue	*Festuca idahoensis*
Green needlegrass	*Stipa viridula*
Bottlebrush squirreltail	*Sitanion hystrix*
Great Basin wildrye	*Elymus cinereus*
Crested wheatgrass	*Agropyron cristatum*
Sheep fescue	*Festuca ovina*
Western wheatgrass	*Agropyron smithii*
Slender wheatgrass	*Agropyron trachycaulum*
Canby bluegrass	*Poa canbyi*
Sand dropseed	*Sporobolus cryptandrus*
Alkali sacaton	*Sporobolus albidus*
Northern sweetvetch	*Hodysarum boreale*
Buckwheat	*Eriogonum*
Annual ryegrass	*Lolium perenne multiflorum*
Western yarrow	*Achillea millefolium lanulosa*
Small burnet	*Sanguisorba minor*
Lewis flax	*Linum lewisii*
Gooseberryleaf globemallow	*Sphaeralcea grossulariifolia*
Scarlet globemallow	*Sphaeralcea coccinea*
Desert globemallow	*Sphaeralcea ambigua*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Palmer penstemon	*Penstemon palmeri*
Wyoming big sagebrush	*Artemesia tridentate wyomingensis*
Chokecherry	*Prunus virginiana*
Black sagebrush	*Artemesia nova*
Shadscale	*Atriplex confertifolia*

[1] Experimental species to be considered near TD1 to promote wildlife habitat could include aspen (*Populus tremuloides*), service berry (*Amelanchier* spp.), and bitterbrush.

Source: BLM 2011.

Table A-3 Interim Reclamation Seed Mix for Stockpiles

Common Name	Scientific Name
Crested Wheatgrass	*Agropyron Cristatum*
Yellow Sweetclover	*Melilotus officianlis*
Fourwing Saltbush	*Atriplex canescens*

Source: SRK 2009.

References

Bureau of Land Management (BLM). 2011. Alternative Plant Species for Reclamation Seed Mix. Email transmittal from J. Daniel, BLM to C. Johnson, AECOM. February 14, 2011.

SRK Consulting (U.S.) Inc. (SRK). 2009. Plan of Operations and Reclamation Permit Application, Dee Arturo Expansion Project. Prepared by SRK Consulting (U.S.) Inc. for Barrick Dee Mining Venture. Submitted to Bureau of Land Management. June 2009.

Appendix B

Special Status Species Identified for the Arturo Mine Project

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Mammals					
Pallid bat *Antrozous pallidus*	BLM; NV-SP	Range: Throughout Nevada. Habitat: Found in a variety of habitats from desert scrub to forests. Roosts in a variety of structures including mines, caves, buildings, and trees. Intolerant of roosts in excess of 40°C.	High. This species has been documented southwest of the study area along Rock Creek. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Townsend's big-eared bat *Corynorhinus townsendii*	BLM; NV-SPS	Range: Throughout Nevada. Habitat: Highly associated with caves and mines. Very susceptible to disturbance at roost sites. Periodically moves to alternate roosts and actively forages and drinks throughout the winter. Typically forages in open forest habitats.	High. This species has been documented southwest of the study area along Rock Creek. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Big brown bat *Eptesicus fuscus*	BLM	Range: Throughout Nevada. Habitat: Found in a variety of habitats including forests, shrublands, and agricultural and urban areas. Roosts in a variety of structures including mines, caves, buildings, and trees. More tolerant of human habitation than other bat species. Roosts in groups of up to several hundred individuals.	High. This species has been documented northwest of the study area in the Santa Renia Mountains. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Silver-haired bat *Lasionycteris noctivagans*	BLM	Range: Throughout Nevada but occurs primarily in forest and riparian habitats. Habitat: A forest associated species often found at higher elevations in piñon-juniper, subalpine fir, aspen, and willow habitats. Roosts almost exclusively in trees in the summer. Frequently alternates roost sites. Maternity roost sites are usually in woodpecker holes.	Low. Marginal roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Western red bat *Lasiurus blossevilli*	BLM	Range: Known from only a few locations in Nevada in Lincoln and Clark counties. Habitat: Found primarily in wooded habitats. Species is a solitary rooster in trees and under leaf litter. Originally thought to only be a migrant in Nevada but small breeding populations may exist in the Fallon and Muddy River areas.	None.	Yes. This species' known distribution in Nevada is outside the study area.	Bradley et al. 2006.
Hoary bat *Lasiurus cinereus*	BLM	Range: Patchy distribution throughout Nevada. Habitat: Tree-associated species. Found primarily in forested upland habitats, as well as in forest riparian zones, and agriculture habitats. May occur in park and garden settings in urban areas. A solitary rooster that typically roosts in trees.	Low. Marginal roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
California myotis *Myotis californicus*	BLM	Range: Throughout Nevada but mainly found in the southern half of the state at lower elevations. Habitat: Found in a variety of habitats from desert scrub to forests. Roosts in a variety of structures including mines, caves, buildings, and trees. Actively forages throughout the winter.	Moderate. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Small-footed myotis *Myotis ciliolabrum*	BLM	Range: Throughout Nevada. Habitat: Found in a variety of habitats from desert scrub to pine-fir forests. Roosts in caves, mines, and trees. Forages in open areas.	High. This species has been documented northwest of the study area in the Santa Renia Mountains. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Long-eared myotis *Myotis evotis*	BLM	Range: Throughout Nevada, primarily at higher elevations. Habitat: Primarily a forest-associated species. Roosts in caves, mines, and under bridges. May forage within mine and cave structures, gleaning moths from the rock walls.	High. This species has been documented northwest of the study area in the Santa Renia Mountains. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Little brown myotis *Myotis lucifugus*	BLM	Range: Found primarily in the northern part of Nevada. Habitat: Found at higher elevations in coniferous forest. Requires a nearby water source. Roosts in trees, buildings, caves, and mines. One of the species most commonly found in human structures.	Low. Marginal foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Long-legged myotis *Myotis volans*	BLM	Range: Throughout Nevada but absent from the low desert. Habitat: Piñon-juniper and other higher elevation forest habitats. Night roosts and hibernacula located in caves and mines. Forages in open areas at canopy height.	High. This species has been documented northwest of the study area in the Santa Renia Mountains. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Yuma myotis *Myotis yumanensis*	BLM	Range: Found in the western, southern, and north-central parts of Nevada. Habitat: Found in a wide variety of habitats from low to mid-elevations, including sagebrush, salt desert scrub, agriculture, playa, and riparian habitats. One of the species that is most tolerant of human habitation and one of the few that thrives in a relatively urbanized environment. Roosts in buildings, trees, mines, caves, bridges, and other man-made structures.	High. This species has been documented northeast of the study area in the Tuscarora Mountains. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status[1]	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Western pipistrelle bat *Pipstrellus hesperus*	BLM	Range: Throughout most of Nevada. More common in the western and southern portions. Habitat: Lower and Upper Sonoran desert habitats of blackbrush, creosote, salt desert shrub, and sagebrush, with occasional occurrence in Ponderosa pine and piñon-juniper, usually in association with rock features such as granite boulders and canyons. Roosts in mainly in rock crevices.	High. This species has been documented southwest of the study area along Rock Creek. Suitable roosting and foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Brazilian free-tailed bat *Tadarida braziliensis*	BLM; NV-SP	Range: Throughout Nevada. Habitat: Found in a wide variety of habitats from desert scrub to coniferous forests. Roosts in caves, mines, trees, bridges, and buildings. Colonies often number in the thousands.	Moderate. This species has not been documented in the project region. The nearest record is approximately 25 miles southeast of the study area along the Humboldt River near Elko, Nevada. However, suitable foraging habitat occurs within the study area.	No.	Bradley et al. 2006.
Preble's shrew *Sorex preblei*	BLM	Range: Northern Nevada. Habitat: Found in a variety of habitats including arid grassland and sagebrush shrubland, forest edges, and willow-fringed creeks and marshes.	High. This species has been recorded approximately 25 miles northeast of the study area near Sheep Creek. Suitable habitat occurs within the study area.	No.	Ports and George 1990; Wildlife Action Plan Team 2006.
Fletcher dark kangaroo mouse *Microdipodops megacephalus nasutus*	BLM; NV-SPS	Range: Throughout Nevada. Habitat: Intermountain desert scrub, sagebrush, grasslands and meadows, badlands and dunes, and areas around desert playas and ephemeral pools.	High. This species has been recorded in Elko County near Halleck, Nevada. Suitable habitat occurs within the study area.	No.	O'Farrell and Blaustein 1974; Wildlife Action Plan Team 2006.
Pygmy rabbit *Brachylagus idahoensis*	BLM	Range: Throughout Nevada but typically found in areas dominated by sagebrush. Habitat: Requires dense sagebrush for cover as well as appropriate deep soils for burrowing (i.e., high clay content). Often found in drainages with taller sagebrush present.	High. This species has been recorded at several locations in the project region. The study area contains areas of suitable sagebrush habitat.	No.	Great Basin Ecology 2009; Miller 2010.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status[1]	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
River otter *Lontra canadensis*	BLM	Range: Northeastern to central-western Nevada. Habitat: Riverine systems and associated marshes, lakes, and ponds. When inactive, occupies hollow logs, spaces under roots, logs, or overhangs, abandoned beaver lodges, dense thickets near water, or burrows of other animals; such sites also are used for rearing young.	None.	Yes. No suitable habitat occurs within the study area. The nearest documented records are south of the study area along the Humboldt River.	Boyle 2006; Wildlife Action Plan Team 2006.
Birds					
Bald eagle *Haliaeetus leucocephalus*	NV-SE	Range: Throughout Nevada. Habitat: Generally nests and roosts in close proximity to large water bodies including rivers, lakes, and reservoirs. Requires abundant food sources such as fish and waterfowl. Breeding period is February 15 to July 15.	Moderate: Occurrence within the study area would be limited to migrating and foraging individuals.	No.	Floyd et al. 2007; Great Basin Ecology 2009; Herron et al. 1985; Johnsgard 1990.
Northern goshawk *Accipiter gentilis*	BLM; NV-SPS	Range: Primarily found in the northern two-thirds of Nevada. Habitat: Deep conifer-dominated mixed forests. May exhibit seasonal migrations depending on prey availability. Preferred nesting habitat is aspen stands within coniferous forests along perennial streams. Breeding period is April 15 to August 1.	None.	Yes. No suitable habitat occurs within the study area.	Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.
Swainson's hawk *Buteo swainsoni*	BLM	Range: Found throughout Nevada, typically in agricultural areas. Habitat: Agricultural valleys and associated uplands. Nests in large shrubs and trees such as cottonwood, willows, and aspen. Breeding period is April 1 to July 15.	High. Known nesting areas occur south of the study area along the Humboldt River. No known nests occur within the study area. Suitable foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Ferruginous hawk *Buteo regalis*	BLM	Range: Throughout Nevada, mainly in the east-central portion of the state. Habitat: Dry, open country. Nests usually occur in trees at the interface between piñon-juniper and desert scrub/grasslands. Forages over open areas with an adequate prey base. Breeding period is March 15 to July 15.	High. No nest sites have been documented within the study area; however, suitable nesting and foraging habitat occurs throughout the study area.	No.	Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.
Golden eagle *Aquila chrysaetos*	BLM	Range: Throughout Nevada. Habitat: Mountain or hilly terrain. Nests usually occur on cliffs or in trees. Forages over open areas with an adequate prey base. Breeding period is March 15 to July 15.	High. No known nests occur within the study area. However, this species has been documented in the vicinity of the study area. Suitable foraging habitat occurs within the study area.	No.	BLM 2008; Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.
Peregrine falcon *Falco peregrinus*	BLM; NV-SE	Range: Southwest and extreme southeast Nevada. Habitat: Open country near cliffs. Typically migrates south of the U.S. during winter months. Nests on cliffs and rock ledges. Forages in open areas typically near water. Breeding period is March 15 to July 15.	None.	Yes. This species' known distribution in Nevada is outside the study area.	Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.
Prairie falcon *Falco mexicanus*	BLM	Range: Throughout Nevada. Habitat: Dry, open country including desert scrub and sagebrush grasslands. Usually nests on cliffs in proximity to suitable foraging habitat. Breeding period is March 15 to July 15.	High. No known nests occur within the study area. However, this species has been documented nesting in the vicinity of the study area approximately 7 miles north of the study area. Suitable foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Herron et al. 1985; Johnsgard 1990.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Greater sage-grouse *Centrocercus urophasianus*	FC; BLM	Range: Throughout Nevada in areas with sagebrush. Habitat: Sagebrush grasslands. Leks are located in open areas in close proximity to escape cover. Nests are located in sagebrush habitat, typically within 2 miles of the lek. Broods are raised in wet, grassy areas near sagebrush. Winter habitat consists of south and east facing slopes with minimal snow cover. Breeding period (including displaying, nesting, and brooding) is March 1 to July 31.	Moderate. No leks occur within the study area; however, suitable nesting, brooding, and wintering habitat occurs throughout the study area.	No.	Connelly et al. 2000; Floyd et al. 2007; NDOW 2010, 2009; Neel 1999; Wildlife Action Plan Team 2006.
Least bittern *Ixobrychus exilis*	BLM	Range: Nests on shallow lakes and wetlands from Sheldon NWR to Ruby Lakes NWR south to Mason Valley WMA in western Nevada. Habitat: Prefers marshes in very fresh water, typically characterized by cattail and/or spikerush. Breeding period is April 15 to July 15.	None.	Yes. Only extremely marginal foraging habitat occurs within the study area.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Sandhill crane *Grus canadensis*	BLM	Range: Breeds in the lower river valleys and interior basins of the northeastern and east-entral regions of Nevada. Habitat: Large irrigated hay meadows, flooded pastures, and grasslands. Also found in agricultural grain fields certain times of the year. Approximately 90 percent of nesting pairs are found in Elko County with additional nesting pairs in White Pine, Eureka, Lander, northern Lincoln and Nye, and eastern Humboldt counties. Breeding period is April 15 to July 15.	None.	Yes. Only extremely marginal foraging habitat occurs within the study area.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Long-billed curlew *Numenius americanus*	BLM	Range: A confirmed breeder at Sheldon NWR in northern Washoe County, Ruby Lake NWR in Elko County, Lahontan Valley in Churchill County, and Fish Creek Ranch in Eureka County. Habitat: Prefers closely cropped grasslands, pastures, wet or dry meadows, either on the fringe of a marsh or in a meadow or broad riverine floodplain such as the Humboldt River. Non-breeding feeding areas include irrigated pastures and croplands, shallow wetlands, and newly plowed fields. Breeding period is April 15 to July 15.	High: Marginal habitat occurs within the study area; however, this species was observed within the study area in the spring of 2011.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Black tern *Chlidonias niger*	BLM	Range: Nests on shallow lakes and wetlands from Sheldon NWR to Ruby Lakes NWR south to Mason Valley WMA in western Nevada. Habitat: Prefers marshes in very fresh water, typically characterized by cattail and/or spikerush. Breeding period is April 15 to July 15.	None.	Yes. Only extremely marginal foraging habitat occurs within the study area.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Western yellow-billed cuckoo *Coccyzus americanus*	FC; NV-SPS	Range: Found mainly in the western and southern portions of Nevada. Habitat: Found in cottonwood, willow, riparian, and other woodland habitats. Prefers dense understories. Breeding period is April 15 to July 15.	Low. Marginal habitat occurs within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Western burrowing owl *Athene cunicularia hypugea*	BLM	Range: Throughout Nevada. Habitat: Open country from desert scrub to grasslands. Often found in or around prairie dog colonies. Nests in burrows. Breeding period is April 15 to August 15.	High. An active burrow was observed immediately west of the study area. Suitable nesting and foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Great Basin Ecology 2009; Herron et al. 1985.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Long-eared owl *Asio otus*	BLM	Range: Throughout Nevada. Found primarily at higher elevations. Habitat: Juniper woodlands, riparian forests, and coniferous forests. Will often take over old hawk, crow, or magpie nests. Breeding period is February 15 to July 15.	Low. Suitable foraging habitat occurs within the study area. However, roosting, and nesting habitat is lacking within the study area.	No.	Floyd et al. 2007; Herron et al. 1985.
Short-eared owl *Asio flammues*	BLM	Range: Throughout Nevada. Habitat: Open country from desert-scrub to sagebrush-grasslands. Nests and roosts on the ground. Forages primarily at dawn and dusk. Breeding period is February 15 to July 15.	High. Suitable nesting and foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Herron et al. 1985.
Lewis's woodpecker *Melanerpes lewis*	BLM	Range: A resident breeder in isolated pockets mainly in the northern half of the state. Habitat: During the breeding season, this species prefers open habitats that facilitate the foraging behavior of hawking for insects. Scattered trees and/or snags are necessary for nesting. Open or park-like ponderosa pine, burned-over stands of Douglas fir, mixed conifer, piñon-juniper, riparian and oak woodlands are preferred nesting areas. Furthermore, this species prefers areas with a grassy and bushy understory. Breeding period is April 15 to July 15.	Low. Suitable nesting and foraging habitat is lacking within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Pinyon jay *Gymnorthinus cyanocephalus*	BLM	Range: Throughout Nevada, although more common in the central and southern portions of the state. Habitat: Piñon-juniper woodlands. Less frequently found in pine forests and sagebrush grasslands. Distribution is determined by availability of food resources. Nests in loose colonies. Breeding period is April 15 to July 15.	Low. Suitable nesting and foraging habitat is lacking within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Juniper titmouse *Baoolophus griseus*	BLM	Range: Found mainly in piñon -juniper woodlands from I-80 south to the Colorado River. Habitat: Strongly associated with piñon-juniper woodlands. Snags and heart rot are assumed to be important in providing nesting cavities. Dense foliage and closed canopies are preferred, while thin understory and ground cover are preferred for feeding activities. Breeding period is April 15 to July 15.	Low. Suitable nesting and foraging habitat is lacking within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Loggerhead shrike *Lanius ludovicianus*	BLM; NV-SPS	Range: Throughout Nevada. Habitat: Open country including desert scrub and sagebrush grasslands. Nests and forages in brushy areas. Breeding period is April 15 to July 15.	High. Suitable nesting and foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Yellow-breasted chat *Icteria virens*	BLM	Range: Throughout Nevada, although more common in the eastern portion of the state. Habitat: Found in cottonwood, willow, riparian and other woodland habitats. Prefers dense understories. Breeding period is April 15 to July 15.	Low. Marginal habitat occurs within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Vesper sparrow *Pooecetes gramineus*	BLM	Range: Nesting has been recorded only in the northern half of Nevada. However, the higher mountain ranges in southern Nevada may provide nesting habitat for the species as well. Habitat: Nests in various open shrub habitats from high elevation valleys to higher mountain slopes and basins. Breeding period is April 15 to July 15.	High. Suitable nesting and foraging habitat occurs within the study area.	No.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status¹	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Black rosy-finch *Leucosticte atrata*	BLM	Range: In Nevada, this species breeds on the highest mountains of Elko and White Pine counties. Habitat: Breeds and nests in alpine tundra habitat. Nests on high ridges and peaks (9,000 to 13,000 feet in elevation) near rock cover, usually in crevices and holes in cliff sides. Breeding period is May 1 to July 15.	None.	Yes. No suitable habitat occurs within the study area.	Floyd et al. 2007; Neel 1999; Wildlife Action Plan Team 2006.
Amphibians					
Columbia spotted frog *Rana luteiventris*	FC; NV-SP	Range: Central (Nye County) and northeast (Elko and Eureka counties), usually at elevations between 5,600 and 8,700 feet. Habitat: Quiet aquatic habitats including perennial streams, ponds, springs, lakes, and marshes. May travel to uplands during wet weather. Females typically lay eggs in late April and May. Tadpoles develop into frogs from mid-summer to late fall.	Low. Known populations exist in the Independence Range approximately 15 miles east of the study area. No known records of this species exist for the study area, although marginal habitat occurs within the 6 small wetlands within the study area and along Boulder Creek.	No.	BLM 2008; Cedar Creek Associates 2009; USFWS 2010b.
Northern leopard frog *Rana pipiens*	BLM; NV-SP	Range: Isolated habitats throughout Nevada. Absent from the southwestern portion of the state. Habitat: Springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes. Usually found in permanent water with rooted aquatic vegetation. During the summer, commonly inhabits wet meadows and fields. Females typically lay eggs in late April and May. Tadpoles develop into frogs from mid-summer to late fall.	Low. No known records of this species exist for the study area, although marginal habitat occurs within the 6 small wetlands within the study area and along Boulder Creek.	No.	Cedar Creek Associates 2009; NatureServe 2010.

Appendix B Special Status Species Identified for the Arturo Mine Project

Common Name/ Scientific Name	Status[1]	Range Habitat Requirements	Potential for Occurrence Within or Near the Study Area	Eliminated from Detailed Analysis	References
Fish					
Lahontan cutthroat trout *Oncorhychus clarkii henshawi*	FT	Range: Found in the Lahontan Basin of northern Nevada and eastern Oregon. Habitat: Occurs in a wide variety of habitats including lakes, rivers, and creeks. Riverine habitat includes cool flowing water with available cover of well-vegetated and stable stream banks.	None.	Yes. No suitable habitat occurs within the study area.	USFWS 2010a,c.
Interior redband trout *Oncorhynchus mykiss gairdneri*	BLM	Range: Washington, Idaho, Oregon, Montana, and Nevada. In Nevada, this species occurs in Elko county in the Long-Ruby Valleys watershed. Habitat: Low-gradient, medium-elevation stream reaches with an abundance of complex pools. Winter habitat includes deep pools with extensive amounts of cover in third-order mountain streams.	None.	Yes. No suitable habitat occurs within the study area.	Behnke 1992
Invertebrates					
Mattoni's blue butterfly *Euphilotes pallescens mattoni*	BLM	Range: Throughout Nevada. Habitat: Arid areas such as desert flats and edges of sand dunes. This species is typically most abundant from early July to September.	None.	Yes. No suitable habitat occurs within the study area.	Butterflies and Moths of North America Online 2010.

[1] Status:
FT – Federally Threatened Species
FC – Federal Candidate Species
BLM – BLM Sensitive Species
NV-SE – Nevada State Endangered
NV-SP – Nevada State Protected
NV-SPS – Nevada State Protected Sensitive

References

Behnke, R. J. 1992. Native Trout of Western North America. American Fisheries Society. Monograph 6. xx + 275 pp.

Boyle, S. 2006. North American River Otter (*Lontra canadensis*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/northamericanriverotter.pdf. (Accessed July 12, 2010).

Bradley, P. V., M. J. O'Farrell, J. A. Williams, and J. E. Newmark, Editors. 2006. The Revised Nevada Bat Conservation Plan. Nevada Bat Working Group. Reno, Nevada. 216 pp.

Bureau of Land Management (BLM). 2008. Draft Supplemental Environmental Impact Statement – Betze Pit Expansion Project. BLM Elko District Office. August 22, 2008.

Butterflies and Moths of North America Online. 2010. Pallid Dotted-Blue (*Euphilotes pallescens*). Internet website: http://www.butterfliesandmoths.org/species?l=1610. Accessed July 12, 2010.

Cedar Creek Associates, Inc. 2009. Wetlands Delineation for the Dee Project. Prepared for SRK Consulting, Inc. September 2008, revised January 2009. 37 pp.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to Manage Sage-grouse Populations and their Habitats. Wildlife Society Bulletin 28(4):967-985.

Floyd, T., C. S. Elphick, G. Chisholm, K. Mack, R. G. Elston, E. M. Ammon and J. D. Boone. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press. 581 pp.

Great Basin Ecology, Inc. 2009. Barrick Dee Project Baseline Survey. Prepared for SRK Consulting, Inc. December 2008 – revised January 2009. 15 pp.

Herron, G. B., C. A. Mortimore, and M. S. Rawlings. 1985. Nevada Raptors: Their Biology and Management. Nevada Department of Wildlife. Biological Bulletin No. 8. 114 pp.

Johnsgard, P. A. 1990. Hawks, Eagles, and Falcons of North America. Smithsonian Institution Press. 403 pp.

Miller, K. 2010. Eastern Region Mining Biologist, NDOW. Email Correspondence with C. Johnson, AECOM, Fort Collins, Colorado. June 3, 2010.

NatureServe Explorer. 2010. Northern Leopard Frog (*Rana pipiens*). Internet website: http://www.natureserve.org/explorer/. Accessed July 2, 2010.

Neel, L. A. 1999. Nevada Partners in Flight Bird Conservation Plan. Internet website: http://www.blm.gov/wildlife/plan/pl-nv-10.pdf. Accessed February 18, 2010.

Nevada Department of Wildlife (NDOW). 2010. GIS Shapefiles. Internet website: http://gis.ndow.nv.gov. Accessed July 9, 2010.

Nevada Department of Wildlife (NDOW). 2009. Nevada Department of Wildlife Upland and Migratory Game Bird, Rabbit and Furbearing Mammals: Harvest Data and Population Status Reports. June 2009. 99 pp.

O'Farrell, M. J. and A. R. Blaustein. 1974. *Microdipodops megacephalus*. Mammalian Species. No. 46:1-3.

Ports, M. A. and S. B. George. 1990. *Sorex preblei* in the Northern Great Basin. Great Basin Naturalist 50(1):93-95.

U.S. Fish and Wildlife Service (USFWS). 2010a. Response to Request for Information Letter from R. Williams, Field Supervisor, Nevada Fish and Wildlife Office, USFWS to M. Brekke, AECOM, Fort Collins, Colorado. August 12, 2010.

U.S. Fish and Wildlife Service (USFWS). 2010b. Columbia Spotted Frog. Internet website: http://www.fws.gov/nevada/protected_species/amphibians/ species/col_spotted_frog.html. Accessed July 2, 2010.

U.S. Fish and Wildlife Service (USFWS). 2010c. Lahontan Cutthroat Trout. Internet website: http://www.fws.gov/Nevada/protected_species/fish/species/lct.html. Accessed July 2, 2010.

Wildlife Action Plan Team. 2006. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno, Nevada. 630 pp.